

DISTRIBUTION STATEMENT A:
Approved for Public Release -
Distribution Unlimited

AIR FORCE JOURNAL *of* LOGISTICS

WINTER
1984



Major General Nathanael Greene
1742-1786
Logistician — Warrior

20040601 114

AIR FORCE JOURNAL of LOGISTICS

General James P. Mullins
Commander
Air Force Logistics Command

Dr. Thomas E. Cooper
Assistant Secretary of the Air Force
Research, Development and Logistics

Lieutenant General Leo Marquez
Deputy Chief of Staff
Logistics and Engineering HQ USAF

Editorial Advisory Board

Mr. Lloyd K. Mosemann II
Deputy Assistant Secretary of the Air Force
Logistics
Department of the Air Force

General Bryce Poe II
USAF (Retired)

Lieutenant General Earl T. O'Loughlin
Vice Commander
Air Force Logistics Command

Lieutenant General George Rhodes
USAF (Retired)

Major General William P. Bowden
Deputy Chief of Staff for Materiel Management
Air Force Logistics Command

Major General Alfred G. Hansen
Director of Logistics Plans and Programs
HQ USAF

Major General M. Roger Peterson
Assistant Deputy Chief of Staff
Logistics and Engineering
HQ USAF

Major General Monroe T. Smith
Commander, Air Force Acquisition Logistics Center
Air Force Logistics Command

Major General Clifton D. Wright, Jr.
Director of Engineering and Services
HQ USAF

Brigadier General John E. Griffith
Director of Transportation
HQ USAF

Brigadier General Gordon P. Masterson
Director of Maintenance and Supply
HQ USAF

Brigadier General Charles P. Skipton
Deputy Chief of Staff, Plans and Programs
Air Force Logistics Command

Brigadier General Bernard L. Weiss
Director of Contracting and
Manufacturing Policy
HQ USAF

Colonel Duane C. Oberg
Deputy Chief of Staff, Logistics
Air Force Systems Command

Colonel Keith E. Burres
Commander
Air Force Logistics Management Center

Mr. Jerome G. Peppers
Associate Dean, School of Systems and Logistics
Air Force Institute of Technology

Editors

Major Theodore M. Kluz
Jane S. Allen, Assistant
Air Force Logistics Management Center

Editor Emeritus

Lieutenant Colonel Pember W. Rocap
Office of Defense Cooperation
APO New York 09784

Contributing Editors

Mr. Joseph E. DelVecchio
Associate Director, Logistics Plans & Programs
HQ USAF

Colonel Gerald F. Saxton
Director of Management Sciences
HQ AFLC

Lieutenant Colonel Edwin C. Humphreys III
Chief, Logistics Career Management Section
Air Force Manpower and Personnel Center

Lieutenant Colonel John H. Roscoe
Chief, Resource Management Studies
Air War College

Lieutenant Colonel David C. Rutenberg
Chief, Logistics Branch
Directorate of Curriculum
Air Command and Staff College

Captain Donald L. Brechtel
Department of Contracting Management
School of Systems and Logistics
Air Force Institute of Technology

Mr. R. A. Reaka
Chief, Logistics Career Program Branch
Office of Civilian Personnel Operations

Graphics

Mr. Bob Ryan
Ms Peggy Greenlee

AFRP
400-1

VOL VIII
NO 1

WINTER
1984

AIR FORCE JOURNAL *of* LOGISTICS

CONTENTS

ARTICLES

- 2 Maritime Prepositioning: A Logistics Readiness and Sustainability Enhancement**
Lieutenant Colonel Ray P. Linville, USAF
- 10 Greene's Strategy in the Southern Campaign, 1780-1781**
Lawrence E. Babits
- 14 The Development of a Combat Analysis Capability for the Air Force Logistics Command**
Lieutenant Colonel Robert S. Tripp, USAF
Captain Larry B. Rainey, USAF
- 18 The Future of Logistics Communications**
First Lieutenant Timothy L. Ham, USAF
- 22 Contracting for Reliability**
Earl T. Steiner
- 24 How Much Do We Need? - What Do We Take?
A Tool To Help—Now!**
Thomas W. Gage
Captain Andrew J. Ogan, USAF
- 27 Logistics Realism in Exercises**
Lieutenant Colonel Ronald D. Hoover, USAF
- 31 The Impact of Rate Stabilization Upon the Air Force Depot Maintenance Industrial Fund (DMIF) Management System**
First Lieutenant Kenneth S. Caldwell, USAF

PRO/CON QUEST

- 35 Fashions in Warfare: Implications
for the Tactical Aircraft**
Leonard G. Gaston
- 37 Logisticsians Are Leaders, Too!**
Dennis E. Campbell
- 38 Plan Ahead—Make Things Happen**
Lieutenant Colonel Walter R. Montgomery, USAF

DEPARTMENTS

- 8 *USAF Logistics Policy Insight*
21 *Career and Personnel Information*
30 *Current Research*
40 *Logistics Warriors*

Purpose The *Air Force Journal of Logistics* is a non-directive quarterly periodical published in accordance with AFR 5-1 to provide an open forum for presentation of research, ideas, issues, and information of concern to professional Air Force logisticsians and other interested personnel. Views expressed in the articles are those of the author and do not necessarily represent the established policy of the Department of Defense, the Department of the Air Force, the Air Force Logistics Management Center, or the organization where the author works.

Distribution Distribution within the Air Force is F through the PDO system based on requirements established for AFRP 400-1 on the basis of 1 copy for every 15 logistics officers, top three NCOs, and professional level civilians assigned.

Subscription For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Back issues are not available.

Manuscripts (typed and double-spaced) should be between 2000-3500 words. References should be numbered and attached at end of manuscript. Figures (separate pages) should be numbered consecutively within the text. Tables should be prepared within the appropriate text (AUTOVON 446-4087; Commercial (205) 279-4087).

BEST AVAILABLE CO

Maritime Prepositioning: A Logistics Readiness and Sustainability Enhancement

Lieutenant Colonel Ray P. Linville, USAF
Chief, JCS/DOD Logistics Planning and Policy
Directorate of Logistics Plans and Programs
HQ USAF, Washington, D.C. 20330

Introduction

Because of the nature of modern warfare, logistics required for combat operations must be in place or readily available. More importantly, logistics planners must anticipate requirements well in advance because of the lead-time factors involved in providing logistics support. As General Ira C. Eaker has warned: "Wars will be won or lost with the military capability possessed when war starts." (10)

For logistics support to be available where needed, it must be properly prepositioned, obtainable from the host nation, or moved using strategic mobility assets. "Prepositioning" is stockpiling equipment and supplies "at or near the point of planned use or at a designated location to reduce reaction time and to insure timely support of a specific force during initial phases of an operation." (39:226) The concept of prepositioning, although not a new one, is receiving increased attention as a means to achieve rapid projection and sustained support of combat forces.

Prepositioning at central depots or other storage locations has been a method for providing a mobility capability with both airlift and sealift resources. Each has its own special strengths, but all are needed to provide a balanced mobility capability (Figure 1). Prepositioning programs are needed to overcome the capacity limitations of airlift and speed limitations of sealift. The Air Force's war reserve materiel program prepositions equipment and supplies at major overseas locations. Recent enhancements to the programs of the other services include prepositioning equipment for a Marine amphibious brigade in Norway and expanding to six divisions the Army's program for prepositioning of materiel configured to unit sets (POMCUS). (40:54-55)

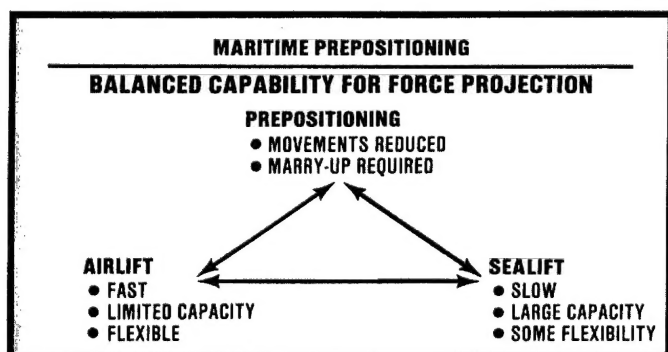


Figure 1.

Prepositioning United States (US) stocks in Europe has been possible because of our access rights and combined military planning with other members of the North Atlantic Treaty Organization (NATO). However, in other regions, notably

Southwest Asia, land-based prepositioning programs have not been successfully implemented because of the lack of access agreements with some countries and congressional reluctance to fund for facilities in those countries where the US has been granted access.

To overcome these deficiencies, the Air Force with the other services has opted to implement maritime prepositioning programs. Maritime prepositioning is a means of storing assets aboard ships. Similar to land-based prepositioning, it provides logistics support in forward areas where land-based programs are not sufficient or cannot be implemented. This paper will examine the need for maritime prepositioning programs, the advantages and disadvantages of such programs, and the major aspects to be considered when implementing them.

The Need

Limited Strategic Lift

Vice Admiral Kent J. Carroll, Commander of the Military Sealift Command, has stated that strategic sealift is "the Achilles heel in the deployment of combat forces outside of the United States." (31) In addition, the Joint Chiefs of Staff have identified the need for additional roll-on/roll-off (RO/RO) ships, tankers, and barge carriers. (40:55)

The Congressionally Mandated Mobility Study stated that additional airlift is needed for both near-term and future mobility requirements. Air Force actions to correct this deficiency include procurement of additional KC-10 and C-5 aircraft, enhancements to the Civil Reserve Air Fleet program, the C-141 stretch and air refueling modifications, the C-5 wing modification, and procurement of additional aircraft spare parts for sustained airlift operations. These improvements are significant; however, Defense Secretary Caspar Weinberger has stated that they will not entirely satisfy our future airlift requirements. (41:III-94—III-96)

Sustaining resupply is critical to the success of combat, and consumption rates continue to increase as modern warfare becomes more sophisticated. Consumption by US forces averaged "65 tons of materiel a day in World War I, 675 tons a day in World War II, and 1,000 tons a day in the Vietnam War." (16)

Operations can only be successful with adequate logistics support. If available lift resources are inadequate to move the increasing amounts of materiel required to support combat forces, more stocks must be prepositioned or more risk must be accepted.

Recent British Experience and Future Conflicts

The case for prepositioning is further strengthened by recent British experiences in the South Atlantic conflict. This

conflict demonstrated the importance of forward bases, facilities, and supplies. Although much time was consumed in attempting to negotiate a peaceful solution to resolve the problem, high British officials, including Prime Minister Margaret Thatcher in June 1982, insisted that delays in action were "strictly for military reasons, to get the troops and supplies to the front, and not for diplomatic purposes." (32)

Because the British lacked sufficient mobility assets and prepositioned stocks, commercial luxury liners had to be pressed into service and American assistance was requested. The *Canberra*, the world's third largest cruise liner, was used to carry 2,500 assault troops. (3) The *Queen Elizabeth 2* (with its four swimming pools, four restaurants, two nightclubs, seven bars, and casino) was used to deploy 3,500 troops and return 600 survivors from three British ships that were sunk. (15) To handle British requests for fuel and other logistics support, a special crisis management team was set up in the Pentagon. (6) On 15 June 1982, Prime Minister Thatcher told Parliament that American assistance during the conflict had been "splendid" and "that Britain had received 'everything we asked for' in logistical and material aid." (9:A18) On the same day, Argentine Foreign Minister Nicanor Costa-Mendez stated that Argentina's surrender was partially due "to the materiel the United States has given to British forces." (8:A20)

The problems that the British faced in conducting operations 8,000 miles from London should be reviewed for applicability to US plans to rapidly project forces and then sustain them. That conflict was approximately the same distance from Britain that the Persian Gulf is from the East Coast if the Suez Canal is open. The Joint Chiefs of Staff have recognized that the problems of long lines of supply and lack of existing support in Southwest Asia must be overcome to support a force operating in that region. (40:99)

General David C. Jones, former Chairman of the Joint Chiefs of Staff, told the Senate Foreign Relations Committee that if Britain had the quick response capability being developed by the US Rapid Deployment Force "it's less likely that Argentina would have made the move into the islands to begin with." (11) In addition, Lieutenant General Larry D. Welch, former commander of Ninth Air Force and thus the commander of the Air Force component of the Rapid Deployment Joint Task Force, has warned that two conditions will seriously affect the US ability to counter Soviet intervention: the theater will be a great distance from the US and the infrastructure to support US forces will be insufficient. (22:73)

The lessons from the British conflict with Argentina and the conditions facing the US as it plans to counter Soviet intervention call for greater prepositioning of logistics support in areas of conflict that are vital to US national interests.

Restricted Access to Bases

Thus, the need for adequate prepositioning programs is critical. However, for non-NATO contingencies, the lack of access agreements, the perturbations of the negotiating process, and congressional reluctance to appropriate funds for military construction programs hinder development of a land-based program. Therefore, maritime prepositioning must be considered.

In the Southwest Asia region, the US has been granted at least limited access to facilities in Egypt, Oman, Kenya, and Somalia. Agreements with Great Britain for using facilities at Diego Garcia and with Portugal for Lajes Air Base further the

US capability to project forces to that region. (41:III-108) However, other Persian Gulf nations are following an "equal proximity" policy, meaning that they want to keep an equal distance between both the US and the Soviet Union. As a result, maritime prepositioning is the only way to prestock supplies for some areas of the Persian Gulf region.

Even when facilities have been made available, Congress has refused to provide construction funds without a formal, written agreement. On 25 May 1981, the late President Anwar Sadat of Egypt openly declared at a news conference: "I am ready to provide the facilities." (29:36) However, eight months later Congress withheld more than \$70 million in construction funds for fiscal year 1982 that had been requested to upgrade facilities at Ras Banas primarily because no formal agreement had been signed with Egypt. (20) In addition, the House of Representatives, in passing its version of the military construction appropriation bill for 1983, denied "all of the \$178.6 million requested for construction of facilities at Ras Banas, Egypt," although funding was partially provided in subsequent action by both houses in a conference session. (42)

Defense Policy Changes

More prepositioning is also required because of the recent changes in defense policy. Defense Secretary Weinberger has stated that US forces "must be prepared to respond to warning indicators that are highly ambiguous" rather than having clear warnings and the sufficient time to respond to them. (41:I-12) This change will require prepositioning more military assets to be ready in potential areas of conflict.

Another change is the move away from focusing predominantly on a war centered in Europe. This change began as a result of the events of 1979—the fall of the Shah of Iran, the seizure of the American embassy in Teheran, and the Soviet drive into Afghanistan. In his State of the Union address in January 1980, President Carter warned that the US would not tolerate any Soviet attempt to gain control of the Persian Gulf region. The Reagan administration has extended this policy by saying that the US should be able to fight Soviet aggression on several fronts and not plan to fight the so-called "one and a half" or "two" wars. (41:I-15) General Maxwell D. Taylor, former Chairman of the Joint Chiefs of Staff, has stated that the Reagan Doctrine requires that US armed forces be ready "to fight and defeat the Soviets any time in any place and, if necessary, in several places at a time." (37) More prepositioning, particularly maritime stocks which are mobile, will be required to be responsive to this policy change.

A third change concerns the anticipated conflict duration. Previous defense policy was to plan for a "short war." This assumption is now officially defunct since it could offer a potential invitation to aggression in a critical region such as Southwest Asia if the US strategy were to sustain only a limited conflict. Planning, therefore, requires increased sustainability and greater prepositioning in vulnerable regions not protected by the presence of US forces. (41:I-17)

Constrained sealift and airlift capabilities, limited access to bases, and recent changes in defense policy clearly mandate the need for effective maritime prepositioning programs. To ensure that they are effective, it is first necessary to understand both their disadvantages and advantages.

Disadvantages

Maritime programs have five main disadvantages: the lack of a land-based commitment, their high cost, the additional

handling and movement required, special offload conditions, and maintenance cycle characteristics.

No Land-Based Commitment

A primary drawback of maritime prepositioning results from its very nature. By prepositioning its assets at sea, the US military commitment to a country is perceived as less tangible than if US resources were physically located ashore. The political, military, and psychological signals that land-based prepositioning send must not be discounted. Recent history has shown the deterrent effect that a permanent US military presence has on Soviet strategy. US policymakers, who are concerned about being "drawn into a direct confrontation with the Soviet Union, have yet to appreciate that the Soviets tend to shy away from such confrontations as much as we do." (26:37)

Land-based prepositioning is also important for host country perceptions. It indicates the commitment and ability of the US to assist in preventing aggression by putting its resources "at risk" in that country. Since a land-based program is generally made more long-term by requiring fixed facilities, an ally would have more confidence in our assurances backed by land-based resources than a maritime prepositioning program.

In addition, because of mobility, a ship and its embarked cargo could be sent to another region if a crisis occurred or a more demanding need were recognized by the US. Such a movement could be interpreted incorrectly as a reduced US commitment to the area where the ship had been stationed.

Finally, the phenomenon of "geopolitical momentum" must be considered. With a land-based prepositioning program, the US would also probably have access to a country's facilities, bases, and airspace. This case is not necessarily true of maritime prepositioning. No sovereign country easily accepts a foreign military presence on its soil. The problem that the US faces in the Southwest Asia region is not retaining existing military footholds but establishing new access to facilities. A land-based program would establish our access and provide "momentum" for obtaining additional rights when needed. (26:32-33)

High Cost

Although maritime prepositioning can greatly enhance readiness and sustainability, it is a very expensive undertaking. The initial costs paid by Military Sealift Command (MSC) in fiscal year 1980 just to start the Near-Term Prepositioning Ships (NTPS) program which began late in that year were \$6.5 million. (24:50) That amount is insignificant when compared to the \$862.8 million that the Navy will pay to charter six auxiliary cargo ships for five years to preposition equipment and supplies for three Marine amphibious brigades. (23)

Daily charter rates for the ships are the major expense. These rates vary by ship according to its size, type, and special capabilities; however, the daily rate for a lighter-aboard-ship (LASH), a vessel well suited for maritime prepositioning programs, can exceed \$33,000, which would be over \$12 million annually. Additional expenses would also be incurred for the maintenance cycle when inspection and preventive repair activities for both the ship and its cargo would be required. Depending on the vessel and its cargo, the ship's annual charter costs could be 15 to 35% of the embarked cargo's value, which means that as frequently as every three years, the ship's costs could exceed the value of the embarked assets.

Additional Handling and Movement

Another disadvantage is that additional transportation—critical intratheater lift—is required to move the items once they are offloaded. This additional movement requires trained personnel and equipment to offload the ship if it is not a self-sustaining vessel. Then transportation must be provided either by host nation support or US resources to move the items to the airfield where they will "marry up" with the deploying Air Force units. Moving the items by air after they have been offloaded from a ship will compound lift shortfalls in the early stages of a conflict. Deploying US ground transportation units to assist in this "marrying up" process would preempt combat forces that could be deployed. In addition, host nation support may not be readily available, even if the country's political leaders support US efforts, because of the poor transportation networks and insufficient logistics infrastructure common to many Third World countries. The difficulty of this "marrying up" process is one reason that the Forward Deployed Logistics Force, a concept developed by Defense Secretary McNamara in 1963, did not enjoy widespread popularity in military circles. (19:42)

Offloading Conditions

A fourth disadvantage involves the conditions necessary for offloading operations. First, the ship must be unloaded in a permissive environment unless adequate combat forces can be assigned to protect it. In addition, protective escort at sea while en route to the discharge area may be required. Secondly, for ships that cannot discharge their cargo offshore, there must be adequate port facilities, including channels deep enough for the ships and pier area for unloading operations. For vessels that can discharge their cargo in the water, there must be a suitable area, including a steady sea state. British action in the South Atlantic conflict was delayed by a storm with winds of more than 40 knots and waves of 16 feet. (7:A1) Facilities must be available not only for handling the dry cargo but also for storing liquid items such as bulk petroleum products and water. Finally, the offloading area must be near an airfield capable of supporting military operations, and there must be adequate road networks between the discharge area and the airfield. These prerequisite, favorable conditions were documented as early as 1964 by the Army when it conducted Exercise Quick Release, a test of its "fast forward positioning" concept. (18:34-35)

Maintenance Cycle Characteristics

A final disadvantage concerns the maintenance cycle for inspecting and repairing the ship and its cargo. If the US does not have access to adequate facilities in the region where the ship is stationed, the ship must be brought out, eliminating all the capability that this concept was designed to provide. Some limited maintenance on vehicles and other equipment items could be conducted on station using a floating barge or similar vessel alongside the ship; however, major repair activities as well as inspection, repair, and certification of the ship itself would be dependent on land-based facilities. In addition, although it could be anticipated, a significant surge in workload would occur for the repair facility selected, creating major production and coordination problems.

Advantages

The disadvantages of maritime prepositioning are not overwhelming or unmanageable. When weighed against the

advantages, one can determine the relative merits of maritime prepositioning (Table 1). The primary advantage of maritime prepositioning is that it supports power projection.

RELATIVE MERITS OF MARITIME PREPOSITIONING

DISADVANTAGES

- No Land-Based Commitment
- High Cost
- Additional Handling and Movement
- Offloading Conditions
- Maintenance Cycle Characteristics

ADVANTAGES

- + Power Projection
- + Reduced Strategic Lift
- + Flexibility and Mobility
- + Political Conditions
- + Maritime Industry

Table 1.

Rapid Power Projection

Maritime prepositioning is responsive to the power projection objectives of the US. It provides logistics support and sustaining power rapidly in the area where needed when other stocks cannot be made immediately available. It has a deterrent value since it signals US commitment and provides a capability to react promptly to regional instabilities.

One of the lessons of the South Atlantic conflict is the importance of forward support near the battle zone. Ships positioned near a potential crisis area can overcome time and space problems. Response time is significantly reduced, thus improving the capability of acting quickly to ambiguous warnings.

Reduced Strategic Lift

By prepositioning equipment and supplies in a region, strategic lift requirements for transporting them from the US or other theaters are eliminated. A ship carrying 10,000 short tons of stocks can save the equivalent of approximately 400 C-141B sorties. Available airlift can be dedicated to moving personnel and the remaining items of combat forces and increasing the combat units deployed. The sustainability elements of power projection that have already been prepositioned no longer compete for critical transportation.

Flexibility and Mobility

A major weakness of all land-based prepositioning programs is their limited flexibility. Once storage facilities have been built, land-based programs are driven by the need to use them. As requirements change and force beddowns are revised, land-based stocks become malpositioned, creating major shortfalls and increased demands for intratheater movements in the early stages of a conflict.

Land-based stocks frequently are prepositioned in areas for political reasons, such as near large population areas to provide more peacetime employment, although their planned use might be elsewhere. The recent Marine program to preposition equipment in Norway for a brigade has been criticized because the site chosen does not support employment plans and it also "handcuffs" the brigade to deploy to only one location. (12:21-22)

With land-based programs, the general location of their use could also be estimated by potential adversaries. However, with maritime prepositioned items, the enemy would have to plan for their use in several locations.

Since stocks afloat are not tied to fixed facilities, they can also be moved to other trouble spots as the need arises without first obtaining permission of another country since a ship can operate unrestricted in international waters.

Political Conditions

Maritime prepositioning is not subject to the same international political conditions of land-based programs.

A country which grants base rights to another for prepositioning subjects itself to several risks. Permitting a foreign military presence represents some infringement on its own sovereignty. It also makes that country a potential target because of an increased military capability now on its soil. Local frictions could develop with the influx of foreign military personnel. Finally, foreign bases or access rights could provide domestic political opponents and revolutionary movements with an anti-government rallying cause. (26:33)

Land-based programs can also be affected whenever the US renegotiates base rights agreements or whenever a foreign government changes its policies concerning a US military presence in its country.

In addition, maritime prepositioning would be affected less by international proposals to create "zones of peace" and remove foreign military bases from a country or region. Such goals have been established by the Association of Southeast Asian Nations.*

Permanent peacetime access to bases would not be required which negates the usual payments required for their use plus the administrative effort to renegotiate access agreements. With Third World nations displaying a more independent foreign policy, greater restrictions on and increased payments for the use of bases in their countries will be the trend. For example, the Philippines barred the use of Clark Air Base for offensive missions during the Vietnam War. Clark, the largest US military installation outside the US, and Subic Naval Base were formally transferred to Philippine sovereignty by the 1979 agreement which costs the US about \$100 million annually. The Philippine government reportedly wants a significantly higher payment, one approaching \$2 billion for the 1984-89 period. (4)

Maritime Industry

Finally, with maritime prepositioning, money spent would generate more revenue and jobs for the dwindling US maritime industry rather than being transferred out of the country as a foreign payment for base rights. The industry has been responsive to both Navy construction and conversion programs and has demonstrated the capability to provide ships for prepositioning programs. In addition to benefiting US shipyards, maritime prepositioning also would not contribute to our foreign debt or balance-of-payments problems.

The advantages of maritime prepositioning are significant. For the US to have a balanced prepositioning strategy, it must include maritime elements.

Implementing a Program

To implement maritime prepositioning, several decisions must be made. These include what commodities should be prepositioned, how they should be inspected and maintained, and what types of ships should be selected.

Commodities

Items selected for maritime prepositioning should have several characteristics. They should be well suited for extended storage and have a long shelf life. Such items include packaged petroleum products, bulk jet and diesel fuel, medical

*Philippines, Thailand, Indonesia, Singapore, and Malaysia

supplies, and subsistence stocks. The new meal, ready-to-eat (MRE), which is replacing the combat ration, is particularly well suited for maritime prepositioning because it has an extended shelf life which, under certain conditions, exceeds eight years.

Items selected should also require very limited maintenance while in storage such as some pieces of bare base equipment and temporary facility substitutes; aircraft tanks, racks, adapters, and pylons; and conventional munitions.

Because a primary advantage of prepositioning is the ability to reduce strategic lift requirements during the early stages of a conflict, items selected should be high volume, heavy weight stocks that would consume large amounts of airlift. They should also be essential to early combat operations before the sea lines of communications can be established; otherwise, they could move by strategic sealoft. Materiel handling equipment, special purpose vehicles, airfield matting, rapid runway repair kits, and other engineering items are possible candidates.

Items that contribute to sustaining combat operations, such as aircraft battle damage repair kits, and those that could improve the local logistics infrastructure, such as tactical pipeline, should also be considered. Finally, extremely high cost items, such as aircraft engines and avionics components, should not be included, since they generally require intensive inventory management and efficient peacetime utilization because of their cost.

Inspection and Maintenance

The types of commodities selected will influence the concept for inspecting, maintaining, and replacing them. In addition, the inspection and maintenance requirements of the ship itself will influence this concept. Each ship must be inspected in a dry dock and certified periodically by the American Board of Shipping. This requirement provides an opportunity to conduct any land-based maintenance and replacement actions.

Items with a limited shelf life could be removed and replaced before their expiration date during the ship's certification period. Those requiring limited maintenance could also be inspected and repaired during this certification period. In addition, a floating repair facility could be used on station for items demanding more maintenance requirements.

Tankers would be used for liquid items such as water and bulk petroleum products. Samples could be taken periodically to verify product quality. At predetermined intervals, tankers could be replaced and their products offloaded for peacetime use before any deterioration occurred.

Ships

The types of ships that should be considered and are now being used in US maritime prepositioning programs include the tanker, RO/RO, breakbulk, and a barge carrying vessel such as a LASH. The tanker and RO/RO are special purpose vessels designed respectively for liquid cargo and wheeled equipment, either towed or self-propelled. The breakbulk and LASH would be used for non-mobile dry cargo with offload conditions determining which should be selected. The breakbulk requires a developed port and also pier assistance, if it is not self-sustaining. On the other hand, the LASH can discharge its cargo in lighters or small barges without shore assistance. A LASH can carry pusher boats, booms for over-the-side operations, and a mobile crane, and has obvious

advantages for discharging its cargo where a fully developed port is not available.

In addition, depending on the commodities selected and anticipated offload conditions, containerhips might have merit for maritime prepositioning.

Operational Considerations

The scope of this paper is primarily limited to the logistics aspects of maritime prepositioning. However, for a fully developed program, there are several operational aspects that should be considered. In addition to those previously mentioned, others include security of the ship and its cargo both at sea and in port while undergoing maintenance, command and control arrangements, and peacetime employment operations.

Current Programs and Experience

Experience with maritime prepositioning has increased greatly since 2 August 1979, when Secretary of Defense Harold Brown proposed the Maritime Prepositioning Ships (MPS) program for the US Marine Corps. This program began in 1983. When completed in 1987, it will provide the capability to preposition equipment and supplies aboard 12 ships for three specially organized Marine amphibious brigades, each of approximately 16,500 men, assigned to the Rapid Deployment Joint Task Force.

Since this program was several years away from completion, an interim measure was begun in January 1980 to give credibility to President Carter's statement that the US would use any means necessary, including military force, to prevent an outside force from gaining control of the Persian Gulf region. Initially called the Near-Term Prepositioning Ships (NTPS) program, it was designed to place a Marine Corps force package in the Indian Ocean region as quickly as possible. The Air Force and Army were able to preposition limited munitions aboard an NTPS vessel when the Marines substituted the RO/RO for a breakbulk ship, thereby providing additional space. The seven ships of the NTPS include three RO/ROs, two breakbulks, and two tankers (one for water and one for fuel) and have been on station in the Indian Ocean since August 1980. Six additional ships were added in 1981 as part of the Expanded Near-Term Prepositioning Ships (ENTPS) program. These ships included three tankers, two LASH barges, and one breakbulk ship.

There are now 17 ships at Diego Garcia and one in the Mediterranean which are part of the Near-Term Prepositioning Force (NTPF). Their cargo includes water, petroleum products, equipment, subsistence stocks, ammunition, and other supplies. These items will provide up to 30 days of support for one Marine amphibious brigade and early deploying Army and Air Force units. (40:98)

In addition, the Navy is considering chartering up to 15 ships for maritime prepositioning programs for up to 25 years. (5:26)

As the maritime prepositioning programs for the Rapid Deployment Joint Task Force were developed, concern was expressed as to the ability of vehicles and other mechanized equipment to withstand the conditions of "sea duty." Potential electronic, hydraulic, optical, mechanical, and corrosion problems could occur which would "make the activation process a difficult and time-consuming matter." (17:42)

The cargo aboard the original NTPS has been inspected during four maintenance cycles which began in February 1981. Results of the maintenance program have proven maritime prepositioning to be successful. Vehicles and equipment of the 7th Marine Amphibious Brigade, which included major end items for both tank and artillery units, were "in exceptional, nearly mint, condition after almost two years afloat." (28:61) Air Force munitions aboard the *American Champion* were also in satisfactory condition. Cargo embarked on the other NTPF vessels has been inspected, and similar results were noted.

In addition to the maintenance programs, exercises involving the NTPF cargo have been held to test the concept of linking the prepositioned items with deploying personnel. The most recent exercise was Freedom Pennant 82 which was conducted in July 1982 in western Australia and was designed to test "plans and procedures to marry up US forces flown from the United States with the equipment and supplies aboard the NTPF." (38) Equipment was offloaded from an RO/RO for inspection and maintenance by the 7th Brigade, which deployed over 900 Marines for the exercise. In addition, discharge capabilities of the water tanker were tested.

Conclusions and Recommendations

In assessing the requirements to project forces, the Air Force needs to have a balanced prepositioning strategy—one which includes maritime programs. The need for maritime prepositioning is validated by the continuing shortfalls in both strategic and airlift capabilities; the British experiences in the South Atlantic conflict and similar conditions involving long supply lines in regions where the US may have to counter Soviet intervention; restricted or no access to bases and facilities in vulnerable regions not protected by the presence of US forces; and recent defense policy changes concerning warning time, geographical focus, and conflict duration. The advantages of maritime prepositioning compensate for its disadvantages since it can overcome the limitations of airlift, sealift, and land-based prepositioning. In some cases, it may be the only means to rapidly project combat forces in a region, reduce strategic lift requirements, provide flexible and mobile resources, and avoid international political constraints. Maritime prepositioning has its greatest merits in supplying and sustaining combat units deployed far from their home station in a region where there is little or no prepositioned stocks ashore or any guarantee of host nation support.

Maritime prepositioning is not a substitute for adequate airlift, sealift, or land-based prepositioning. Instead it complements them to achieve rapid projection and sustained support of combat forces. As General James P. Mullins, Commander of the Air Force Logistics Command, has stated: "Logistics required to accomplish the mission must essentially be in being or readily available." (1:28) Maritime prepositioning helps to obtain this objective and is a major

logistics readiness and sustainability enhancement which significantly increases combat capability.

Editor's Note: Since this article was first written, the Rapid Deployment Joint Task Force was deactivated and the US Central Command was activated on 1 Jan 83.

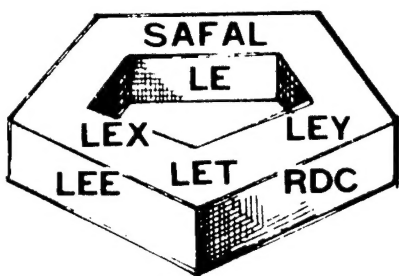
References

- Berry, F. Clifton, Jr. "AFLC Keeps USAF Ready to Fight," *Air Force Magazine*, August 1982, pp. 28-33.
- "Britain Enlists QE2 as Troop Transport," *Washington Post*, May 4, 1982, p. A15.
- "British Train to Survive Using Cows, Mousetraps," *Washington Post*, May 10, 1982, p. A25.
- Branigin, William. "Manila's Policy Shift Brings Bases' Value Into Question," *Washington Post*, September 15, 1982, p. 20.
- Carroll, Vice Admiral Kent J. "Sealift's Role in Strategic Mobility," *Defense Transportation Journal*, August 1982, pp. 25-27.
- "Crisis Team Aided British in Falkland Dispute," *Air Force Times*, May 17, 1982, p. 2.
- Diehl, Jackson. "Argentine Forces Brace for Falklands Invasion," *Washington Post*, May 21, 1982, pp. A1ff.
- Diehl. "Buenos Aires Junta Faces Deep Divisions," *Washington Post*, June 16, 1982, pp. A1ff.
- Downie, Leonard, Jr. "15,000 Prisoners Taken in Surrender," *Washington Post*, June 16, 1982, pp. A1ff.
- Eaker, Lieutenant General Ira C. "Introduction to Some Observations on Air Power." Speech delivered at the Air Force Academy, October 19, 1978.
- "Falkland Shows RDF Need," *Air Force Times*, May 10, 1982, p. 2.
- Fallon, Major M. O. "The Marine Corps' Pre-positioning Mistake," *Marine Corps Gazette*, July 1982, pp. 21-22.
- Frankel, Glenn. "British Bomb Airfields on Falklands," *Washington Post*, May 2, 1982, pp. A1ff.
- Frankel. "British Launch Invasion of Falklands; Argentine Warplanes Counterattack," *Washington Post*, May 22, 1982, pp. A1ff.
- Frankel. "QE2 Brings Wounded to Emotional Homecoming," *Washington Post*, June 12, 1982, p. A24.
- Halloran, Richard. "U.S. Would Expand Combat Stockpile," *New York Times*, August 22, 1982, p. 17.
- Hanks, Rear Admiral Robert J. "Rapid Deployment in Perspective," *Strategic Review*, Spring 1981, pp. 17-23.
- Holzbauer, Major Joseph R. "RDF—Valid and Necessary, But Some Negative Implications," *Marine Corps Gazette*, August 1980, pp. 33-38.
- Krulak, General Victor H. "The Rapid Deployment Force: Criteria and Imperatives," *Strategic Review*, Spring 1981, pp. 39-43.
- "Lack of Pact Delays Ras Banas Buildup," *Air Force Times*, January 18, 1982, p. 12.
- Larus, Joel. "Diego Garcia: Political Clouds Over A Vital U.S. Base," *Strategic Review*, Winter 1982, pp. 44-55.
- Liggett, Lieutenant Colonel William R. "Long-Range Combat Aircraft and Rapid Deployment Forces," *Air University Review*, July-August 1982, pp. 72-81.
- "MAC, Navy Contract For Carriers, Ships," *Air Force Times*, September 13, 1982, p. 24.
- "Military Sealift Command," *Defense Transportation Journal*, February 1981, pp. 48-53.
- Moorer, Admiral Thomas H., and Alvin J. Cottrell. "In the Wake of the Falklands Battle," *Strategic Review*, Summer 1982, pp. 23-28.
- Moorer and Cottrell. "The Search for U.S. Bases in the Indian Ocean: A Last Chance," *Strategic Review*, Spring 1980, pp. 30-38.
- Noll, Lieutenant Colonel E. P. "RDF and the RDJTF," *Marine Corps Gazette*, August 1980, pp. 30-32.
- "NTPS Equipment Maintenance," *Marine Corps Gazette*, July 1982, pp. 59-61.
- O'Ballance, Edgar. "The Rapid Deployment Force, Another Look," *National Defense*, February 1982, pp. 34-36ff.
- "RDJTF Exercise," *Marine Corps Gazette*, September 1982, p. 7.
- "Reagan Reported Planning Military Sealift Upgrading," *Washington Times*, September 9, 1982, p. 5.
- Ross, Jay. "British Maintain Silence on Fighting in Falklands," *Washington Post*, June 4, 1982, p. A22.
- "Sea Lift for the RDF," *Translog*, May-June 1981, pp. 71-74.
- Shoultz, Colonel Eugene E. "Long Term Solution—MPS," *Marine Corps Gazette*, August 1980, pp. 57-59.
- "Six New Ships Are Added to NTPF," *Marine Corps Gazette*, November 1981, p. 10.
- Sulik, Colonel R. A. "Maritime Prepositioning: Near Term Fix—NTPS," *Marine Corps Gazette*, August 1980, pp. 52-56.
- Taylor, General Maxwell D. "This Is No Way to Reform the Joint Chiefs," *Washington Post*, September 10, 1982, p. A27.
- "U.S., Australia Conduct Joint Exercise," *The Pentagon News*, July 24, 1982, p. 23.
- U.S. Department of Defense. Organization of the Joint Chiefs of Staff. *JCS Publication 1, Department of Defense Dictionary of Military and Associated Terms*. Washington, DC: U.S. Government Printing Office, 1979.
- U.S. Department of Defense. Organization of the Joint Chiefs of Staff. *United States Military Posture for FY 1983*. Washington, DC: U.S. Government Printing Office, 1982.
- Weinberger, Caspar W. *Annual Report to the Congress, Fiscal Year 1983*. Washington, DC: U.S. Government Printing Office, 1982.
- Weinberger. Letter to Senator Paul Laxalt, Chairman, Senate Subcommittee on Military Construction, September 9, 1982.
- West, F. J., Jr. "Limited U.S.-Soviet Conflict and the RDF," *Marine Corps Gazette*, August 1980, pp. 39-46.
- Wilson, George C. "Panel Balks at Financing Red Sea Military Base," *Washington Post*, June 3, 1982, p. A26.



"Logisticians have traditionally been second cousins and second-class citizens. Things will change."

(General Bryce Poe, II, 1979)



USAF LOGISTICS POLICY INSIGHT

Spares Requirements

The Air Staff developed a "top down" aircraft replenishment spares forecasting model last year to improve out-year forecasts of funds required to procure aircraft spare parts. The model output was successfully used in the development of the FY84 President's Budget and the FY85-89 Program Objective Memorandum (POM). After the FY85 POM cycle was completed, the model was exported to the Air Force Logistics Command (AFLC) for refinement and linkage to the Air Force requirements computation process. This has been completed and AFLC is in the process of marketing their new Air Logistics Early Requirements Technique (ALERT) model for Air Staff approval. This "bottom up" model uses item specific information to forecast out-year funds. After Air Staff approval, the ALERT model will be used in the FY86-90 POM to aggregate aircraft replenishment spares Peacetime Operating Stock funds.

Materials Handling Costs

Headquarters Air Force has requested that Air Force contract administration activities review contractor methods for allocation of materials handling costs to the prices for spare parts to assure that these methods (1) consider the value of the spare part and (2) do not distort the unit prices of spare parts. Assignment of fixed materials handling charges to each of a list of spares will sometimes underprice high value spares, while the price of the low value spare would far exceed its intrinsic value. Wide publicity of such seemingly overpriced low value items has cast DOD contracting in an unnecessarily bad light.

Intermodal Air/Land Containerization

A recent test jointly conducted by the Military Airlift Command and US Army Material Development and Readiness Command proved two significant advantages of air/land containerization. First, containers could be stuffed more cheaply than building pallets and, second, more cargo can be airlifted in containers than on pallets during wartime. Based on these and many other test findings, the Air Force is entering the revolutionary world of intermodal transportation with the purchase of 50 intermodal air/land containers to support the identified requirements of the Army Air Line of Communication to Europe. The containers 20 x 8 x 8 ft meet International Organization for Standardization requirements and can be moved by aircraft (C-130, C-141, C-5, or B-747) or truck, rail, or ship. As requirements grow, other users will be added.

Design and Construction Management

The Air Staff is taking a new look at the design and construction management policies and philosophies applied to the military construction (MILCON), Operations and Maintenance, and nonappropriated funds (NAF) facility construction programs. A Washington-based analysis firm is conducting the review which will involve representative levels of design and construction management. Expected recommendations include improved management efficiency and control, coordinated policies for all programs, better use of management information systems, and needed training areas. Ultimately, these recommendations will be the basis for the rewrite of AFR 89-1, *Design and Construction Management*.

Data Rights

The Air Staff has begun a major review of Air Force data rights policies and the part they play in the spare parts acquisition process. During the next several months, the Director of Contracting and Manufacturing Policy will be reviewing and updating Air Force data rights policies and procedures to support Secretary Orr's five-year proprietary rights initiative. This new requirement requests the transfer of data rights to the government not later than 60 months after the first production delivery. This contract provision will apply to solicitations and contracts that anticipate life cycle spare parts requirements in excess of \$500,000. Other data policy areas to be reviewed include contract data flow-down requirements, limited rights legends, and data warranties. The objective of this entire effort is to substantially improve the Air Force's acquisition and use of contract data to support increased competitive contracting.

Reserve Equipment Status

Congress is increasingly interested in the equipment and missions assigned to the Reserve Forces. This is demonstrated by the FY82 requirement to submit an annual report on Reserve equipment status and the precedent shattering FY83 appropriation of procurement funds directly to the Reserve Components. Momentum continues into FY84 with a requirement to examine missions for possible conversion to the Reserve components; tentative language which directs future budget submissions to include separate Reserve procurement appropriations; and, finally, language which restricts the formation of new, active C-5B units pending transfer of C-141s to the Guard.

Preproduction Manufacturing

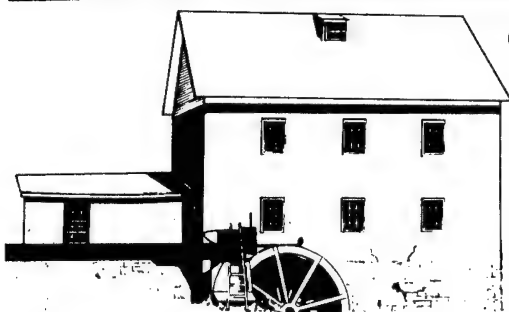
AFR 800-9, *Manufacturing Management for Air Force Contracts*, October 1983, now requires that logistics be considered in contractor preproduction manufacturing planning to ensure adequate, efficient capacity to support post production support requirements. The Air Force Production Engineering Support Office (PESO) will solicit logistics input for the independent assessment provided to the AFSARC/DSARC. The insight gained by contractor preproduction planning can then be used to positively effect post production support capacity before it is fixed in place by the production decision.

CEMAS

Responsive logistical support has been a continuing problem for Civil Engineering. The Standard Base Supply System (SBSS) has difficulty meeting the unique Civil Engineering requirements which are generally non-stock listed, purchased locally, and have unpredictable usage rates. Therefore, additional support systems were needed to supplement the SBSS. To rectify this, however, Air Staff and MAJCOM functional areas have developed the Civil Engineering Materiel Acquisition System (CEMAS). This system includes the best features of all current systems in a single dynamic Civil Engineering support package. It is government controlled, user friendly, responsive, and cost-effective, and uses "state-of-the-art" computers. Tinker AFB is presently conducting a full-scale testing of this prototype. The future goal is to replace all existing Civil Engineering supply systems worldwide with a single responsive method: CEMAS.

Cryptology Support

In the future, Air Force expects many of our new communications-electronics (C-E) systems entering the Air Force inventory to have embedded cryptography. Traditionally, depot maintenance responsibility for COMSEC equipment and systems has been assigned to the Air Force Cryptological Support Center, Kelly AFB, Texas. An evaluation will soon be conducted to determine if the depot responsibility for C-E systems employing embedded cryptography could best be accomplished at locations assigned overall system depot maintenance responsibility. If adopted, this would preclude establishing split depot capabilities for C-E systems falling into this category.



Greene's Strategy in the Southern Campaign, 1780-1781

Dr. Lawrence E. Babits

Assistant Professor of History and Archaeology
Armstrong State College (University System of Georgia)
Savannah, Georgia 31406-7189

Abstract

Nathanael Greene was one of the true heroes of the War for Independence: first, as a 33-year-old Major General; later, as Washington's Quartermaster General; and, finally, as Commander of the Army of the South. He was, to our mind, one of the most capable logistics warriors in our history. The following article, part of a larger work, deals with Greene in the Southern Campaign.

Nathanael Greene was operating with an army that was basically infantry. This force was capable of some rather extended marches, but the average daily distance was approximately 12.75 miles.¹ This distance reflected the settlement pattern of the region since the army usually marched from early morning to about noon, and then camped.² Other extenuating factors included the poor roads and the lack of adequate transport to carry equipment and provisions.³ In an extreme case, the army was capable of marching over 30 miles at a time, but this distance would require a longer resting period.⁴ Statistically, the army camped in close proximity to mills virtually every night,⁵ although some were remote from the army. Since the army spread out at least 1 mile as it marched,⁶ the headquarters and a portion of the army might be at the mill itself, while other units might be quite some distance off.

In addition to the normal reasons for camping at mills—open space, water, and grain—they indicated the extent to which Greene exploited the totality of the regions through which he marched. Mills are often associated with the county-level command structure through the militia ranks given mill owners. A great many of the mills were owned, if not operated, by members of the local elite who could be identified by their high militia rank.⁷ Thus, Greene, acting as the military commander, required the local leadership, the elite of the county, to produce those supplies which his army needed simply by operating within the chain of command. In effect, Greene mobilized an already existing political-military structure to meet the short- and long-term requirements of his soldiery. Doing this enhanced the stability of the patriot political system and also identified those who were not supportive of the cause.

It is axiomatic that an army travels on its stomach. Greene's troops were no different, but their fare was lean indeed. On many occasions, they went without food and their rations rarely came close to matching those stipulated by the regulations. Greene's effort to procure foodstuffs for his army reached monumental proportion, and further study of his letters to determine precisely what percentage dealt with food would be illuminating. Greene's strategic use of the piedmont to feed his men can be illustrated by two isolated, but typical, examples.

The first episode begins with a letter which details how the militia forces, operating around the Moravian (North Carolina) settlements in early 1781, gathered supplies for the army. Although the Moravian villages were somewhat to the north of the line of march for both the "flying army" and the main army, Greene's commissary troops were gathering supplies in advance of them which could then be ground at mills in the vicinity of Guilford Courthouse.⁸ In addition, sweeping up flour could speed issuing, while gathering grain could impede the British by causing them delays in gathering and processing food. It is a particularly succinct commentary on the supply situation and the fluid nature of the campaign that I have yet to identify a single instance of mill destruction by either side. Even though Greene did not specify that all materials were to be removed by foraging parties during February 1781, it is clear this kind of operation was underway and Greene certainly ordered the total removal of supplies ahead of the British in March 1781.⁹

"The importance of prepositioning supplies cannot be overestimated."

When Greene marched his army back into South Carolina in April 1781, he moved slowly enough so supplies could be placed in mills ahead of the line of march. To ensure foodstuffs on the march, he issued orders to the county colonels, telling them to bring grain to central locations. This can be seen in letters to Greene written by Colonel Thomas Wade. Wade was writing from Haley's Ferry, a day's march ahead of the main army which was then at Kimborough's Mill on Little River.¹⁰ Three days later, the army was at May's Mill where the provisions were apparently not sufficient since the army stayed only 1 night.¹¹

The importance of prepositioning supplies cannot be overestimated. It was necessary to rest the horses, if not the men, at 5-7 day intervals.¹² An overnight stay developed into being on a site for 2 days. Two days would virtually exhaust an area of supplies if they had not already been augmented by collection prior to the army's arrival.¹³ Greene clearly understood this and he ordered Polk to maintain a 3-day supply of provisions at magazines within 2 weeks of his arrival at Charlotte in December 1780.¹⁴ Since the vast majority of the camps were of 1 night's duration, a 3-night camp involved a great deal of prior effort to ensure that adequate food would be on hand. Only 15 camps lasted for more than 3 nights, while only 18 camps were 2 or 3 nights' duration. The analysis of camp duration suggests that the army moved in accordance with the presence of supplies gathered ahead of it, as much as in response to the availability of supplies at its current location or enemy movements.

At no time did the army issue more than 3 days' rations to the men during the Southern Campaign. This is because the

men would have had to carry the provisions, and the added weight probably would have been dealt with by consuming it immediately, especially because of available short rations. Yet the requirement for 3 days' rations, which is repeated on numerous occasions, has antecedents related to infantry marching and carrying rates which were as true in Alexander the Great's time as in Greene's time. It was simply impossible for an army to carry more than 3 days' rations.¹⁵

As a result of Greene's experiences in the North and the situation in the South, he became his own quartermaster general, while also directing the army in maneuvers against the British. As he traveled south in October and November 1780, Greene had called on Congress and the state legislatures to provide the needed supplies. These were easily promised, but actually obtaining them proved far more difficult. Nevertheless, the long-range planning instituted by Greene from the start of his journey south was to pay dividends in the early summer of 1781. The clothing which reached Greene's army at Ninety Six provides an excellent opportunity for understanding Greene's logistic sense as it related to uniforming his command.

Only a single example of uniform transportation and issuing will be presented. There are others which amplify the situation, as well as illuminating Greene's thoughts on uniforms and how they were procured. Despite the scattered nature of the sources, it has been possible to trace the movement of three different clothing issues from the point of origin to the place of issue. The supply convoy first appears in the records as originating in Philadelphia, although it seems as if a portion of the clothing came from Newburgh, New York.¹⁶ The letter to Greene mentions that 25 wagons had set out from Philadelphia for the Southern Army. It is clear from other documents that the convoy did not leave Philadelphia until at least 29 March because the invoices of supplies are dated then.¹⁷ The invoices note the quantity of materials in each box and give box numbers, so it is possible to trace these items rather easily.

The wagon train is mentioned in another letter, dated 5 April, stating that it was being conveyed under the direction of Barney Hart.¹⁸ Again, this letter to Greene originated in Philadelphia. By the end of April, the convoy had reached Carter's Ferry, Virginia, but now had only 24 wagons and was without guards.¹⁹ By 17 May, the group had reached Salisbury, North Carolina, and numbered only 22 wagons, giving some testimony on the attrition which occurred to overland transportation.²⁰

On 21 May, Greene sent Major Lewis Morris, an aide, to bring the convoy on from Salisbury.²¹ This is important to note because Greene was about to commence siege operations at Ninety Six, yet he was more concerned with outfitting his troops than documenting the siege. Morris was at Charlotte by the 24th and ordered the brigade of wagons and the troops from Salisbury to the army. The directions are quite explicit as each stopping place and river crossing is stated.²² On 1 June, the supplies had apparently reached the army because a return of clothing wanted was made at Ninety Six.²³ The Clothier General for Maryland reports the clothing was issued on 10 June, so it is apparent that the uniforms were reaching the troops in the field some 70 days after leaving Philadelphia.²⁴

Any person who studies the returns, invoices, and issuing receipts will note that the invoices contain few references to overalls although many were issued. The halt at Salisbury explains this because Salisbury, now a major producer of clothing, was also a center of shirt and overall production for

Greene's army in 1781.²⁵ The layover of the wagon train would have allowed the time to load overalls missing from the Philadelphia invoice. These overalls and shirts were available in May 1781 because the countryside around Salisbury had been producing them since December 1780 per Greene's instructions.²⁶

... it is clear that Greene's planning involved the total resources of the area he was defending."

In this example, it is clear that Greene's planning involved the total resources of the area he was defending. The people had been asked to provide supplements long before the actual need was present. This is not readily apparent until inspection of supply movements, together with invoices, identifies what was brought from the North and what was actually issued. Once the documents are examined in this fashion, it is certain that the Southern Army would have been without overalls had Greene lacked the foresight to order them made locally some 6 months before they were issued.

In order to supply his men with arms and ammunition, Greene started one laboratory at Salisbury, North Carolina,²⁷ and a second in Virginia.²⁸ Both of these operations continued to supply the army with materiel, but they had constant problems. Again, the major difficulty may have been transport and its susceptibility to the weather, as cartridges were often reported useless when wet.

Munitions were also brought overland from the North. Among the 22 wagons which finally reached Salisbury in May 1781, 10 contained ammunition. Included in this total at the start of the journey south were nearly 100,000 musket cartridges and assorted shot for the artillery.²⁹ Because of the amount of materiel damaged in transit, the production of ammunition at local laboratories was a necessity if Greene's troops were to continue the struggle. Again, the long-range planning instituted by Greene in December 1780 and January 1781 was crucial to his army's ability to fight in May, June, and July when the British were driven into coastal South Carolina.

The constant problem with transportation which permeates Greene's correspondence was dealt with by trying to convert wagon convoys to packtrains. This response to the crude road network and the sorry state of equipment was taken prior to March 1781,³⁰ but it never rid the army of its transport woes since wagons were still used and the roads were not improved.

Perhaps the most revealing aspect of Greene's strategic sense can be seen in his movement of troops around the piedmont. The number of days spent in any one camp has already been mentioned, but a closer look is necessary. The supplies of food at a camp would be depleted rather rapidly with the arrival of the army.³¹ Consequently, Greene ordered that magazines be established which would contain 3 days' food supply so the army could rest at least 1 day and still have sustenance to march to another supply point without food.

Of the 133 camps between 1 June 1780 and 30 August 1781, only 42, or 31.5%, were more than 1 night. Even then, only 15, or 11%, were more than 5 nights. The poor roads and transport, coupled with the area's ability to provide food, were reflected in camp duration. Greene's planning coped with the supply problem by storing supplies ahead of the army on the march, but the difficulty grew worse with a longer stay in

camp. At the longer camps, Greene resorted to another method of supplying his men. This different approach involved the river system of the piedmont. Greene's application of rivers to supply his men provides a clue to his using the piedmont in purely military terms because it is the key to understanding his strategy during the campaign.

In conjunction with Greene's placement of long-term camps and troop movement, he made a major strategic decision in December 1780. He sent Daniel Morgan and a "flying army" to the west, while he moved the main force to the Pee Dee River just below the North Carolina border. The division of forces might be seen as violating the principle of mass, but Greene was using economy of force to achieve a portion of his strategy by breaking "down the enemy's control while simultaneously preventing him from interfering with" the main army.³²

In the main camp at Hick's Creek on the Pee Dee River, Greene busied his army in many ways as the militia continued to provide supplies. The transport of those supplies had changed somewhat because there are calls for boatmen in the orders to bring in the foodstuffs.³³ Greene was simply using water transport in addition to wagons in his effort to supply the army. At the same time, boats were constructed with wheels to enable them to move with the army so stream crossing would be possible.³⁴ Both water related activities reflect Greene's strategic sense of the river system in piedmont Carolina.

While at Hick's Creek, Greene also authorized a raid on Georgetown, South Carolina, which was to be, in part, an assault by troops who would float down the Pee Dee River and land at the town docks. Again, knowledge of the river system enabled the tactical attack to be accomplished. In a tactical sense, this little known attack on Georgetown, to the east of the main British outposts at Camden, Winnsboro, and Ninety Six, might have shifted British attention away from Morgan's small force operating on the headwaters of the Broad River. It certainly tends to confirm the statement that Greene understood a river better than those who had grown up in the vicinity of the Catawba, another river Greene used during his campaign.³⁵

"Dividing his forces provided them with a better opportunity to obtain supplies."

Greene's strategy in dividing his forces thus becomes a little clearer. Dividing his forces provided them with a better opportunity to obtain supplies and disrupted British attempts to forage in the same area. By controlling the headwaters of drainage systems from which the British were deriving their sustenance, Morgan, Greene and their partisans intercepted the supplies at their source. The British do not adequately report that they were using watercraft to provide transport for supplies, but some references can be found to that effect.³⁶ If the British were supplying their outlying garrisons with waterborne food, then those supplies had to be moved upstream, against the currents in storm swollen rivers, after Morgan and Greene moved to their positions in December 1780, because they effectively cut all rivers about the garrisons.

Another example of strategic riverine use can be deduced for the period after Morgan's defeat of Tarleton and Cowpens on 17 January 1781. Greene made a rapid withdrawal to Virginia which broke the back of the British supply system. For one thing, Cornwallis destroyed his wagon train to lighten

his troops for the pursuit.³⁷ Yet Cornwallis was to pursue Greene into an area from which Greene was withdrawing. As Greene retreated, he brought all the boats to his river crossings and then removed them after the American troops passed. In addition, the militia were used to sweep the area for food supplies ahead of the armies, thereby denying both supplies and the means of transporting them to the pursuing British.

Only when Greene crossed into Virginia and found himself downstream from Cornwallis did he turn and commence the maneuvering that led to the battle at Guilford Courthouse. In light of his earlier interdiction of supplies going to the British along drainage systems, Greene's turning to fight can possibly be explained as necessary. The Southern Army had moved onto a river system which led to another British army located downstream. If it remained on the river, Cornwallis would be upstream and able to interdict any supplies moving along the river.

As it worked out, Greene had already overextended the British. Cornwallis turned and entered Hillsborough, North Carolina, in an effort to recruit and resupply troops. During the "race to the Dan," Greene had used defensive tactics which forced the British to pursue in such a fashion and to such a degree that, even though Greene was forced to retreat, he still retained control of his actions and avoided disintegration of the army while breaking down the British ability to wage war.³⁸

For the same reasons, Greene did not follow Cornwallis to coastal North Carolina after Guilford Courthouse because, since it was possible to obtain supplies from upstream, the area had been so thoroughly covered by both armies that the Americans were fainting from the lack of food just when they commenced their pursuit.³⁹ Unwilling to risk another period of starvation, Greene turned into an area which had provided him with food during the stay on Hick's Creek in December and January.

Greene's return to South Carolina shows again the superb strategic sense he possessed. He began to conduct a harassing campaign against scattered British garrisons. The weaker ones were attacked and taken, and the stronger ones were subjected to a campaign of supply interdiction which eventually caused their abandonment. Greene used the same procedure that had proven successful in January. He had partisan raiders intercept both wagon- and boat-carried supplies heading for the British, while he made the situation intolerable by threatening the garrisons with military forces as well.⁴⁰

The interdiction of supplies continued even after the British abandoned the piedmont to the rebels in the summer of 1781. Confined to a narrow coastal strip running from north of Charleston to south of Savannah, the British were faced with the choice of abandoning the southern states or starving to death.⁴¹ Greene had cut off the coastal area from the hinterland and its supplies upon which the British depended.⁴²

Greene acted throughout the Southern Campaign as if he were still the quartermaster general who had restored order to the supplying of the Continental Army. He obtained supplies while denying them to the British. It was almost as if he put himself in the place of the British quartermaster's office and designed the worst possible scenario for the British. When doing so, he utilized the resources of the piedmont in a massive effort to maintain his own forces. This application of the political, social, economic, and military resources of the Carolinas gave him a victory. His use of the resources was far more than simply maneuvering his army through a series of battles because his strategic objective was to maintain his army in the field no matter what happened. Even though Greene

suffered from bad luck and conservative judgment in tactical situations on the battlefield, he was successful because his "comprehensive direction of power" broke the British, despite never winning any battles.⁴³ In this sense, his manipulation of the resources to obtain supplies required for his military strength has to be seen as the major strategic effort of the Southern Campaign which won the South for the United States.

"The British could defeat his army, but they could not destroy it."

At its most basic level, Greene's strategy can be seen in the maintenance of the Southern Army. His performance, and that of Washington in the early war years, probably did more for winning the Revolution than any other two campaigns. By maintaining a military presence, Greene continually demonstrated that the Revolution was still in effect in the South. The British could defeat his army, but they could not destroy it. Greene's battered Continentals served as a flickering beacon of revolution in the South during 1780 and 1781. In the end, Greene's strategy of mobilizing the entire Carolina countryside to support his Maryland, Delaware, and Virginia regulars proved to be the key to winning the South once and for all.

(Although they might not agree with the conclusions in this paper, I am indebted to Richard K. Showman and Robert McCarthy of the Nathanael Greene Papers, Rhode Island Historical Society, for their continuing commentary and assistance during 1977-1980. This paper would not have been possible without their aid.)

The Author

Editor's Note: General Greene, of all our Revolutionary War leaders, keenly understood the relationship between logistics and success on the battlefield. Most military historians agree that the triumph of the Patriot forces in the South was largely due to his generalship. In fact, in U.S. military history (1742-1786), General Greene has few equals and for that reason we dedicate this issue to his strengths. We quibble with Dr. Babits on one issue, however, and that is in his references to Greene's "strategic sense." We would much prefer he use the Clausewitzian terms of "the mastery of fog and friction" to describe Greene's battlefield savvy. This is excerpted from a larger study by Dr. Babits, who is the son of a deceased Air Force career officer.

Notes

¹Babits, L. E. "Military Documents and Archaeological Sites: Methodological Contributions to Historical Archaeology." (Ph.D. Dissertation, Brown University, 1981), p. 62. Joseph B. Turner, ed. *The Journal and Order Book of Captain Robert Kirkwood*. Wilmington, Historical Society of Delaware, 1910, p. 13.

²Gist, Mordecai. *Orderly Book, Manuscript 390*, Vol. III, Collections of the Maryland Historical Society, Baltimore.

³Gist. *Orderly Book*; William Smallwood, *Orderly Book, Domestic Collection*, Library of Congress, Washington, D.C.

⁴Turner. *Kirkwood Order Book*, p. 13.

⁵Babits. *Military Documents*, p. 88.

⁶Mercur, James. *Elements of the Art of War*. London: MacMilland, 1889, p. 127.

⁷Babits. *Military Documents*, p. 93.

⁸Morgan, Daniel. "Letter to Nathanael Greene," 7 February 1781, Harvard University Library, Cambridge.

⁹Greene, Nathanael. "Letter to Francis Malmady," 18 March 1781, William L. Clements Library, Ann Arbor.

¹⁰Pendleton, Nathaniel. *Orderly Book*, Library of Congress, Washington, D.C., 1781.

¹¹*Ibid.*

¹²Engels, Donald W. *Alexander the Great and the Logistics of the Macedonian Army*. Berkeley: University of California Press, 1978, pp. 154-4.

¹³*Ibid.*, pp. 45-6.

¹⁴Greene. "Letter to Thomas Polk," *State Records of North Carolina*, XV, p. 179, 1780.

¹⁵Engels. *Logistics*, pp. 21-22.

¹⁶Pickering, Timothy. "Letter to Nathanael Greene," Library of Congress, Washington, D.C., 3 February 1781.

¹⁷Macklin, John. "Invoice of Goods Sent to the Southern Army," Nathanael Greene Papers, William L. Clements Library, Ann Arbor, 23 March 1781.

¹⁸Walton, George. "Letter to Nathanael Greene," *History of American Documents*, Part III (203). Philadelphia: Rosenback Co, 1926.

¹⁹Compt, Thomas. "Letter to Nathanael Greene," Nathanael Greene Papers, William L. Clements Library, Ann Arbor, 28 April 1781.

²⁰Read, James. "Letter to Nathanael Greene," Nathanael Greene Papers, William L. Clements Library, Ann Arbor, 17 May 1781.

²¹Greene. "Letter to Lewis Morris," Nathanael Greene Papers, William L. Clements Library, Ann Arbor, 21 May 1781.

²²Morris, Lewis. "Letter to Unknown Recipient," Nathanael Greene Papers, William L. Clements Library, Ann Arbor, 24 May 1781.

²³Anonymous. "General Return of Cloathing," Nathanael Greene Papers, William L. Clements Library, Ann Arbor, 1 June 1781.

²⁴Randall, John. "Accounts of the Clothier General for Maryland," Manuscript 1814, Collections of the Maryland Historical Society, Baltimore, 1780-1781.

²⁵Greene. "Letter to Joseph Marbury," Nathanael Greene Papers, William L. Clements Library, Ann Arbor, 16 January 1781; Joseph Marbury, "Letter to Ichabod Burnet," Nathanael Greene Papers, William L. Clements Library, Ann Arbor, 16 January 1781.

²⁶Smith, R. "Letter to Nathanael Greene," Nathanael Greene Papers, William L. Clements Library, Ann Arbor, 7 July 1781.

²⁷Greene. "Letter to the Board of War," Nathanael Greene Papers, William L. Clements Library, Ann Arbor, 28 July 1781.

²⁸*Ibid.* "Letter to Baron Von Steuben," 5 March 1781.

²⁹Compt, J. "Invoice of Cannon and Musket Ammunition," Nathanael Greene Papers, William L. Clements Library, Ann Arbor, 29 March 1781.

³⁰Burnet, Ichabod. "Letter to Nathanael Greene," Nathanael Greene Papers, William L. Clements Library, Ann Arbor, 4 March 1781.

³¹Engels. *Logistics*, pp. 45-6.

³²Rosinski, Herbert. *Strategy*, p. 64.

³³Greene. "Letter to James A. Lillington," Nathanael Greene Papers, William L. Clements Library, Ann Arbor, 16 January 1781.

³⁴*Ibid.* "Letter to Daniel Morgan," 19 January 1781.

³⁵Rankin, Hugh. *North Carolina Continentals*, p. 274.

³⁶Bowler, R. Arthur. *Logistics and the Failure of the British Army in America*. Princeton: Princeton University Press, 1975, pp. 90-1.

³⁷Rankin. *North Carolina Continentals*, p. 273.

³⁸Rosinski. *Strategy*, p. 64.

³⁹Greene. "Letter to Samuel Huntington," Nathanael Greene Papers, William L. Clements Library, Ann Arbor, 30 March 1781.

⁴⁰Bowler. *Logistics*, pp. 90-1.

⁴¹*Ibid.*, pp. 86-87, 89, and 153.

⁴²Rosinski. *Strategy*, p. 64.

⁴³*Ibid.*



Most Significant Article Award

The Editorial Advisory Board has selected "Contracting Out of AFLC Functions" by Wayne R. Gracie as the most significant article in the Fall 1983 issue of the *Air Force Journal of Logistics*.

The Development of a Combat Analysis Capability for the Air Force Logistics Command

Lieutenant Colonel Robert S. Tripp, USAF
Senior Project Manager

Captain Larry B. Rainey, USAF
Operations Research Analyst

Command Initiatives Directorate
DCS/Plans and Programs
Wright-Patterson AFB, Ohio 45433

Introduction

There is a growing interest within the Air Force Logistics Command (AFLC) to strengthen the role of the weapon system program managers (SPMs) in handling aviation spares and component repair. The roots of this interest lie in a scarcity of spares and repair resources when measured against the requirements and in an increased awareness of the necessity to relate those resources to system oriented readiness outputs. Because of this concern, an AFLC prototype combat analysis capability (CAC) has been established to provide the air logistics center (ALC) commander with a predictive capability that will demonstrate weapon system impacts of alternative spares support policies and resource levels. This could be a key step in enhancing SPM effectiveness and improving the support available to the major commands (MAJCOMs). The CAC program, if successful, could be expanded to include other logistics resources and processes.

The prototype CAC has been built around previous work done with the RAND Corporation to determine the payoffs of increasing SPM responsibilities in the spares area and to identify the types of information needed to achieve those payoffs. (1-4) Initial investigation indicates that the required information focuses on the establishment of a quantitative readiness measurement/resource management relationship. Because spares support problems are complex in structure, involve costly resources, and impact on many operating and support organizations, we will discuss a program to apply, field test, and evaluate a prototype system.

Information System Support

The full implementation of the management concept requires three different types of information flow. Information support structures are required for capability assessment functions, capability tracking functions, and problem item reporting and feedback functions. This implementation would not require large-scale information system development since most of the data used can be extracted readily from the present systems. Another important feature of the concept is that information system support can be developed incrementally. For example, the assessment system can be developed independently from the performance tracking and problem item reporting subsystems.

Future growth in modeling the depot repair and wholesale supply systems and applying them to AFLC offers the prospect of a richer array of data for ALC commander and staff use in performing functions inherent in the following information systems.

The Combat Analysis Capability

The CAC system is the keystone of the concept. It is a capabilities measurement system for quantifying projected combat performance outputs for given resource levels and employment/deployment parameters.

Inputs. Figure 1 shows the major inputs required to conduct the integration assessments—logistics, operations, and deployment data. This assessment model requires very detailed information in each category. For instance, in the *logistics* area, it requires the failure rate, base and depot repair times, order and ship times, and stockage at each base and depot for each item of interest. In the *operations* area, it requires the number of aircraft at each base, the number of sorties per day, and the average flight duration of each sortie. In the *deployment* area, it requires force changes by base in the future and changes in sortie requirements over time. This assessment technique must be very detailed at the SPM level because the solutions to problems lie in pinpointing specific items.

Because of the large amount of data required to conduct these assessments, preprocessors have been developed to collect this information from existing systems to create the Dyna-METRIC data base. Basically, these preprocessors collect logistics factors, asset information, and wartime operational employment and deployment information for the weapon system being evaluated. Since Dyna-METRIC considers the impact of shop replaceable unit (SRU) shortages on line replaceable unit (LRU) availability, LRU/SRU relationships must be collected and fed to the model. In addition, the model is loaded with authorized and on-hand levels of stock for each base, including peacetime operating

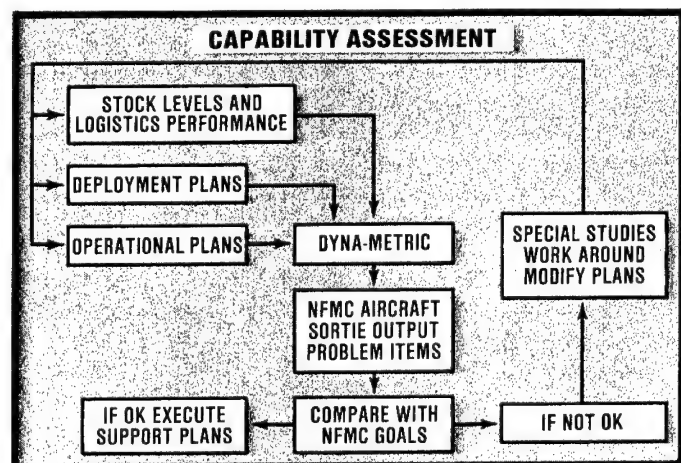


Figure 1: Dyna-METRIC Assessment Schematic.

stock and war reserve materiel. This data base is built and maintained on a weekly basis to evaluate significant Operation Plans (OPlans) and track weapon system get-well plans.

Outputs. The outputs from the assessment system must identify combat capability as a function of logistics resource inputs. This technique must also pinpoint items and processes and provide some diagnostic capability which helps isolate the problem area. These considerations have been key parameters in Dyna-METRIC output design and development.

The Operational Tracking System

The capability assessments must be made against a particular set of standards so that one can compare capability against the requirement. So far, the discussion has centered on analyses which indicate how our logistics support plans (authorized stock levels and item factors which set stockage levels, buys, and repairs) prepare us to meet planned wartime scenarios. To close the loop on this analysis, a comparison must be made between our actual logistics support structure performance and our planned performance in order to facilitate remedial action. As indicated, we will examine the impact on combat capability and look at not only authorized but on-hand spares levels.

To be effective, this portion of the system needs to isolate particular problem items or processes which limit attainment of planned operational readiness objectives. For example, if a certain item limits sortie production, the system should provide indicators showing the limiting constraint. In other words, we must find out if the item is a problem because its repair cycle is longer than the planned time, or the order and shipping time (OST) is longer than planned, or there is a shortage of assets in the system.

Inputs. In order to meet these requirements, the operational tracking system needs to assimilate many items of specific information. The PACAF Combat Support Capability Management System (CSCMS) experience provides an example of how this function can be accomplished. (3) In this system, the program established limits for each important item parameter which specified when operational commitments could not be met.

How often should tracking system reports be received? In the PACAF prototype, data was collected daily from the MAJCOM UNIVAC 1050-II system. This data was then summarized and the products promulgated on a monthly basis. However, before taking action, it was necessary to accumulate some trend information on choke points and critical stock numbers. Perhaps a minimum of three months of unsatisfactory performance is an adequate signal that some remedial action is necessary. Since most of the mechanisms have been developed to collect this data as part of PACAF CSCMS, incorporation of this feedback system as part of an expanded Air Force-wide system is an attractive option.

Outputs. The format for this system is very similar to the assessment outputs but is more detailed in the diagnostic area. This level of detail is needed for system program manager/item manager and MAJCOM evaluations. In fact, the outputs can be obtained and displayed by base, shop within a base, aircraft by command, items by base, and items by command. These outputs need to reside within the computer support system and be printed or displayed only on command.

The Critical Item Reporting and Feedback System

To ensure that assessment and tracking systems lead to management actions to correct problems, we need a critical

item reporting and feedback system. The purpose of this system is to identify critical items to the appropriate IMs for corrective action and to the appropriate SPMs for current status reports on weapon systems. Experience in many Dyna-METRIC applications has shown that the number of problem items/processes limiting sortie generation is small. This means that the IMs/SPMs will not be swamped by large numbers of problem items/processes.

The formats of critical item and feedback reports need to be developed, but they could be patterned after the existing problem item report lists. In fact, negotiations are now in progress to place some of the CAC problem items on the critical item lists. The design of the reports should allow for proposed IM solutions (additional buys, expedited repairs, redistribution of assets) to be reviewed and coordinated with the appropriate SPM(s). This process should be based on automated routing, approval, and feedback to avoid delays.

These proposed reports could replace some of the problem item reports the IMs currently receive. They could also provide the only source of information on how their items are performing against plans and how degradations impact sortie generation capability. This proposed reporting system is advantageous because it is predictive rather than historical as is the current system. Also, one way to eliminate duplicative reporting would be to report not mission capable supply (NMCS) history along with forecast problem items.

Implementation Strategy

Because the job is big, we are planning to segment the work to develop pieces of the CAC. An initial prototype system has been developed which shows that it is feasible to build a logistics combat assessment tool that relates logistics support options to front-end measures of merit. In addition, it is a learning device which provides system specifications for follow-on expansions of the system. We will learn, for instance, how many and what sizes of computers we need to evaluate projected wartime logistics support. Finally, this system provides operational data to improve wartime logistics support for selected weapon systems and logistics resources and processes.

Portions of the system are now operational at OO-ALC, HQ AFLC, and HQ TAC. The prototype development is limited to assessing the impact of repairable spares, base and depot supply and repair functions, and intratheater and intertheater transportation structures on combat capability (sortie generation capability and aircraft availability). The first year will only include data bases for the F-4, F-16, F-15, E-3A, and A-10 systems.

We will be initially measuring the impact of required spares versus on-hand spares within the range of items contained in the war readiness spares kit/base-level self-sufficiency spares (WSRK/BLSS) to determine sortie generation capability. Dyna-METRIC will be used to evaluate whether actual resource levels and logistics functional area performances are sufficient to meet wartime taskings. Identifying such shortfalls should lead to improved resource planning and control to assure adequate wartime capability. The Dynamics Research Corporation (DRC) has been selected to develop and maintain the model and required data bases, and to make weekly assessments against potential major wartime scenarios.

We plan a modular development of CAC until all logistics resources and processes needed to launch sorties are included

in the system. Figure 2 shows a schematic of our contractor supported CAC Module 1. The solid lines represent major data system interfaces and the dashes represent users of the system. The SPMs will be charged to conduct weekly OPLAN assessments and give them to HQ AFLC for review. The data bases will be accessible for quick turn "what ifs." The data base for the analyses will be updated at least weekly with actual quantities of spare parts "on-hand" for each squadron tasked in scenarios under investigation. This "on-hand" data resides in the MAJCOM Combat Supplies Management System (CSMS). A major source of expected wartime logistics factors is contained in AFLC data systems; for example, the WRSK computation system (D029). This and other AFLC systems will be input and updated in the CAC prototype as required.

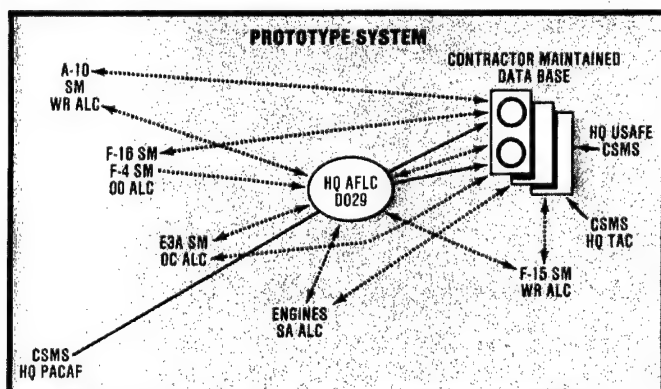


Figure 2: Schematic of Contractor Supported CAC Module 1.

The CAC system collects and computes weapon system oriented measures, such as projected aircraft availability or not fully mission capable (NFMCA) aircraft in any projected conflict, and detects problems in a simulated wartime environment. Some examples of displays generated from the CAC system are shown in Figures 3, 4, and 5.

Figure 3 shows daily sorties as a function of day of war and number of assets on-hand. This output also provides the capability to contrast required sorties against those that can be generated with authorized and/or on-hand assets.

Figure 4 shows the percent of aircraft that are not fully mission capable (NFMCA) because certain repairable spares are not available on particular days of the war for both planned and actual on-hand quantities. This chart shows that many aircraft are on the ground due to spares shortages. Therefore, both measures need to be examined carefully for every scenario.

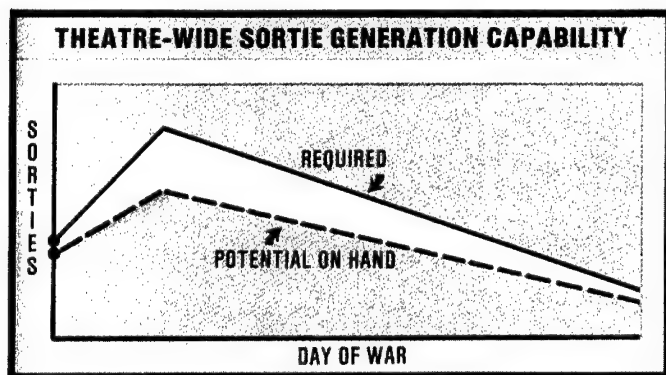


Figure 3.

Finally, Figure 5 provides a list of problem items which limit the number of available aircraft established as a target

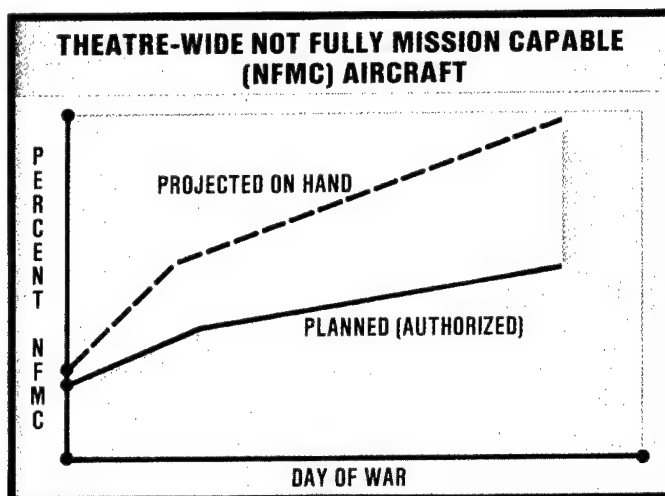


Figure 4.

goal. This predictive list can then be worked by the operating staff to establish get-well plans and examine how the get-well solutions impact readiness.

Instead of using actual number of sorties and NFMCA aircraft for the displays, one could show the ratios of actual and planned capability against what is required to support the war plan. An example of how this information could be displayed using ratios is shown in Figure 6. This figure also shows some threshold limits that could be used to determine if underlying processes should be reoriented. As an example, 90% or .9 could be selected as the ratio of projected, achieved sorties to required sorties that would receive no management visibility.

CRITICAL ITEMS AT DAY 15					
WUC	NOMENCLATURE	PRIME ALC	AUTH	O/H	QUANTITY DEMANDED AT DAY 15
74DA0	INU	OO	16	0	14
74AA0	FIRE CTRL RDR ANTENNA	OO	15	0	10
74DD0	FIRE CTRL PANEL	OO	15	0	5
74AC0	FIRE CTRL RDR TRANSMITTER	OO	15	0	7
62CA0	VHF RECEIVER/TRANSMITTER	WR	5	0	3
24BE0	EPU VALVE	SA	3	0	6
42AB0	GENERATOR	SM	3	0	10
23HAB	ELECTRONIC CTRL, ENGINE	SA	7	0	11
24DDJ	HYD VALVE, JFS DOOR	OO	7	0	1
46CA0	VHF RECEIVER/TRANSMITTER	WR	5	0	4

Figure 5

On the other hand, all ratios of .75 or below could be singled out for management attention. Associated with each ratio is a problem parts list as shown in Figure 6. This list of parts "demanded" to satisfy the wartime sortie generation requirements could be considered as the "demand vector" for products needed to satisfy the war plan. Such a vector could be provided to portray the demand requirement for a given item at specific time intervals (5-, 10-, 20-, and 30-day increments). This demand vector would represent targets for the IM to generate to meet minimum wartime support requirements.

Summary

Overall, the combat analysis capability is very important to the AFLC C³I system. It has been prototyped and successfully demonstrated and is presently operational at HQ AFLC, OO-ALC, and HQ TAC. A second module is being added to

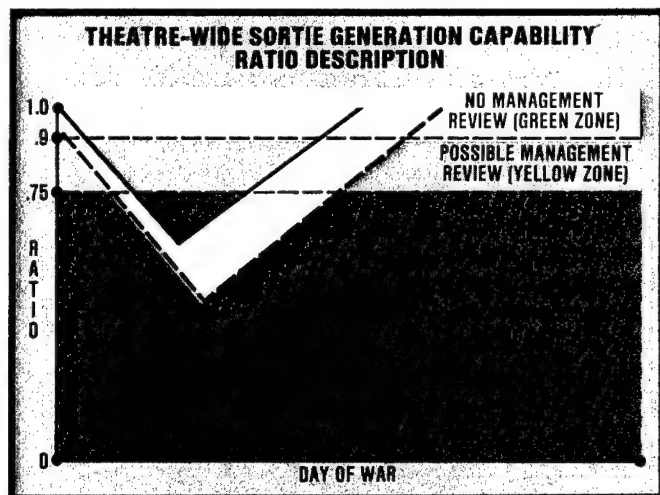


Figure 6.

facilitate operation at the four other ALCs. After we initiate work on the concept of the operational tracking system and complete details on the critical item reporting system, CAC will continue to significantly enhance AFLC's role in supporting the operational commands in the future.

References

1. Hillestad, R. "Dyna-METRIC: A Mathematical Model for Capability Assessment and Supply Requirements When Demand, Repair and Resupply are Nonstationary." Santa Monica, CA: The Rand Corporation, R-2785-AF, 1982.
2. Pyles, R. A. "The Dyna-METRIC Readiness Assessment Model: Motivation, Capabilities, and Uses." Santa Monica, CA: The Rand Corporation, R-2886-AF, 1982.
3. Pyles, R. A., and Lt Col (USAF) R. S. Tripp. "Measuring and Managing Readiness: The Concept and Design of the Combat Support Capability Management System." Santa Monica, CA: The Rand Corporation, N-1840-AF, 1982.
4. Tripp, R. S., Major (USAF), and J. Wennefeld. "Improving the Capability of System Managers to Manage Aviation Spares and Component Repair." Santa Monica, CA: The Rand Corporation, WD-1202-AF, 1981.



Item of Interest

Logistics Over the Shore

The following key actions are recommended to build a reliable Logistics Over the Shore (LOTS) capability:

- Define a minimum LOTS requirement that supports the RDJTF. Provide a clear goal to the services.
- Refine service roles and missions for LOTS operations. The Navy should have sole responsibility for offshore discharge of container ships to Army and Navy lighters.
- Insure that force structure meets the needs of new equipment being procured. The Navy should review manning plans for the Cargo and Port Handling Group.
- Fund only watercraft and supporting equipment that directly support a LOTS requirement. Seek better use of civilian watercraft resources to meet coastal and harbor missions.
- Invest in LOTS equipment that is deployable, maintainable, and capable of sustaining high tonnage requirements. Buy equipment that will perform in rough seas and austere environments. High-tech equipment is not the answer.
- Encourage greater cooperation among the services in fielding and operating LOTS systems. Use JLOTS II in 1983-84 to build a joint capability. Two overlapping systems are not rational and will never be funded.

From a monograph by
Dan J. Beakey, NDU 82-6

Item of Interest

1984 Airpower Symposium

The 8th Annual Airpower Symposium will be held 5-7 March 1984 at the Air War College, Maxwell AFB, Alabama. This year's theme is the United States Air Force Role in Security Assistance. Panels will address (1) Security Assistance Policy, Responsibilities and Organization; (2) Implementation of Current USAF Security Assistance Program and Training; (3) Impacts of Security Assistance on the USAF; and (4) Issues, Initiatives and Trends. More information on the Symposium may be obtained from:

Lt Colonel Richard J. Eyermann
Airpower Symposium
Air War College (AWC/EDRP)
Maxwell AFB AL 36112

Telephones:
AUTOVON 875-2831
Commercial (205) 293-2831

The Future of Logistics Communications

First Lieutenant Timothy L. Ham, USAF
ADP Communications Program Manager
Hq Air Force Logistics Command (LM)
Wright-Patterson AFB, Ohio 45433

Abstract

The merging of computer technology and communications technology presents vast opportunities to introduce new methodology in logistics management and operations. As distributive processing and local area networking become a part of the logistics community, logisticians and communicators must be aware of what is available to provide efficient service to the operational forces.

This paper presents some suggestions for enhancing data communications through the use of state-of-the-art equipment and new concepts in data communications networking and transmission media.

Current and future projects in teleprocessing and local and wide area networking within the Air Force Logistics Command are discussed as examples for integrating computer and communications technology. Problems of standardization, interoperability, and security protection are also addressed.

Finally, expectations for the future of data communications are proposed, based on recent developments in communications media and technology.

Introduction

The future of computers and the future of communications will be largely indistinguishable. Developments in communications focus on new ways of digital control, and new technologies in computer design tend toward enhancements in networking and communications compatibility. The inevitable merging of the two is already obvious in industry and in market projections, and the military logistics community stands to benefit greatly from that merger. An understanding of what is currently available in computer communications is necessary to provide a vantage point to prepare for the future properly.

Department of Defense Networks

Many manufacturers offer off-the-shelf components for data networks, and many businesses find the equipment suitable for their needs. However, DOD data communications systems have special performance requirements which are more stringent than requirements for commercial systems. Survivability, reliability, security, precedence, and interoperability with other DOD networks are requirements that spawned AUTODIN I, the DOD common-user, store-and-forward, message-switching data network. A number of other special-purpose Defense networks exist because of special capacity or security requirements which AUTODIN cannot meet. Nevertheless, as former Deputy Secretary of Defense Frank C. Carlucci stated in his 2 April 1982 memorandum terminating AUTODIN II and establishing the Defense Data Network (DDN), "It remains DOD policy that all data communications users will be integrated into this common user network. Exceptions to this policy must continue to receive the approval of the Deputy Under Secretary of Defense for C³I."

The DDN, based on ARPANET technology, satisfies worldwide wartime survivability requirements that would not have been met by AUTODIN II. The increased cost over the rates of current dedicated lines, the low priority given to logistics traffic, and the small number of nodes contributed to the negative response of the Air Force Logistics Command (AFLC) toward AUTODIN II. The distributed nature of the network and adaptive routing increases the survivability of DDN and more closely resembles the architecture planned for logistics communications.

The initial configuration of the Defense Data Network, DDN I, is a single, integrated packet-switching data network of 171 nodes which will meet the requirements of 91 subscriber systems. These systems consist of 488 hosts and 1,446 terminals that will be connected directly to the network. End-to-end encryption will provide security level separation of information using internet private line interfaces (IPLIs). It is expected that DDN I will be fully configured and operational by the end of FY86. Then, DDN I will evolve into DDN II with the development of multi-level secure hosts and the employment of BLACKER devices replacing the IPLIs.

Host systems will be expected to use the transmission control and internet standard protocols. Other methods of interfacing include front-end processing and terminal emulation. DDN I provides adequate survivability through dual-homing redundancy, dispersion of nodes, adaptive routing, and mobile reconstitution.

The DDN is a step in the right direction for logistics communications. The proven ARPANET technology promises the closest thing to off-the-shelf communications and standardized components capable of meeting the unique needs of the military. The development risk is low, and the benefits of interoperability and modularity reduce maintenance and logistical support cost.

AFLC Initiatives

The AFLC has taken a lead in initiating computer communications networks for its logistics community. The trend toward distributive processing—the use of small specialized computers tied together to reduce or eliminate the need for large data bases—will result in an increased requirement for high-speed communications circuits within and between AFLC facilities. This trend to higher data exchange levels is expected to continue at an increase of 10% to 15% per year as AFLC computer operations move from large-scale computers and batch processing to smaller computers and on-line distributive processing.

Several projects and concepts are planned or in use in AFLC's modernization program. An AFLC command and control concept is being developed to provide decision-making support for the command. Also, the Air Staff-directed Logistics Information Management Support System (LIMSS) will improve information processing at all logistics levels.

"The next decade will see an increase in travel costs and the resultant increase in video and electronic blackboard teleconferencing."

Other special-purpose networks are being developed within the command. The European Distribution System and the Engineering and Services Computer Network will meet the special needs of their communities. Since AFLC is a prime candidate for wideband satellite communications, the Defense Communications Agency (DCA) has recommended that AFLC be the prototype for leased commercial satellite support.

The next decade will see an increase in travel costs and the resultant increase in video and electronic blackboard teleconferencing. AFLC currently has this capability and plans full motion video when DCA completes the installation of a DOD satellite communications capability.

The Commander's Information Network System (CINS) provides managers and executives with instant availability of information required to manage the more than 500 data systems in AFLC. The system includes electronic messaging, word processing, color graphics, data management, and connection to a PDP-11 for access to the UNIX network. It is estimated that the system will comprise a substantial percentage of the estimated increase of 250 terminals per year at each AFLC base.

A local area network is planned for AFLC, using broadband, dual-cable technology. The 450-MHz bandwidth will allow practically every conceivable use of the network. Future customers will connect to the network through a bus interface unit, which will each handle two devices. Connection to the DDN is planned, as well as dial-up and satellite access.

"A properly researched statement of requirements and adoption of a particular communications protocol can have a synergistic effect on a DDP network. . . ."

Networking Standards

Local area networks (LANs) interconnect a collection of potentially diverse computers and terminals. The host computers may range from microcomputers to mainframes. The terminal may be dumb or intelligent enough to independently control or process data on a number of disc drives and other peripherals and communicate with other devices. It is the latter device, the microcomputer, that will figure largely in the move toward distributed data processing (DDP). Each work station or host computer will be capable of communication with any other node. The necessity for a common communications interface and command language is obvious, and should be defined early in the network planning process. A properly researched statement of requirements and adoption of a particular communications protocol can have a synergistic effect on a DDP network, eliminating protocol conversion and retrofit. Such adoption may narrow the field of vendors, but may also have the positive impact of preventing computer manufacturers and network users from committing themselves to unique and incompatible protocols.

The Department of Defense is moving toward standardization with MIL-STD-1777, *Internet Protocol Standard*, and MIL-STD-1778, *Transmission Control Protocol Standard*, which were adopted by the Air Force on 1 March 1983.

The Air Force is taking a lead in establishing data communications standards with several members serving as DOD representatives on various standardization committees. To further direct standardization efforts, DOD has entered into a cooperative venture with the National Bureau of Standards through a memorandum of understanding to develop joint funding to establish data communications standards. The National Bureau of Standards has developed Federal Information Processing Standards (FIPSs) based on the internet, transport, session, data presentation, and file transfer layers of the International Organization for Standardization (ISO) Reference Model of Open Systems Interconnections (OSI). These protocols can provide the logistics user with one standard that is applicable to most communications technologies, including long-distance and local area networks. Also, these protocols are specified at a very detailed level so they may be cited in procurements and implemented by suppliers with reasonable assurance of proper operation.

"Optical fiber transmission lines are becoming increasingly more attractive as a transmission medium for data communications."

Transmission Media

The current installation practice for local data communications circuits is to use twisted-pair wire and solve any noise problems with error-correcting modems and multiplexers. The need for greater bandwidth and higher data rates demands better media.

Optical fiber transmission lines are becoming increasingly more attractive as a transmission medium for data communications. Many problems inherent in copper systems do not affect fiber communications—electromagnetic interference, ground loop problems, cross talk, and susceptibility to radiation interception and wiretapping. The security offered by optical fibers makes the medium cost-effective in military applications requiring such protection. The move afoot to protect sensitive data and Privacy Act data with the same protection afforded classified information makes fiber optics a viable option when planning data networks. Additionally, the small size, light weight, and bending radius of the fiber cable make it ideal to extend lines through already crowded cable troughs. Applications range from short data links within a building to long trunk circuits between cities or bases. Signal attenuation of fiber cable is very low, and projected mean life of some light-emitting diodes and lasers exceeds 100 years.

The extremely high data rate possible with optical cable is most important to data communicators. Potential rates up to 10^{14} bits per second may be reached over fiber optics. Using several fibers in a parallel data bus arrangement provides a communications interface offering virtually no delay to most central processing units.

The large bandwidth of optical cable also makes available an integration of several communications services multiplexed on one cable. Data, voice, video, and fire and intrusion alarm

systems could occupy much less cabling room using fiber optics, while increasing their reliability. Standardized, reusable connectors are also available to make this medium attractive to maintenance personnel.

As more remote graphics terminals go on-line requiring interaction with a mainframe at speeds in excess of 19.2 kilobits per second (kbps), the cost of upgrading metallic lines increases greatly. However, a fiber optic cable installed initially could handle expansion with no change to the cable.

Practical line-of-sight laser communications is a viable option for tactical and logistics communications. Satellite-to-ground laser communications provides a small footprint, although problems exist with atmospheric conditions at most logistics supply centers.

Communications Problems

Most base communications facilities were designed to support analog voice. Individual circuits were modified and conditioned to support data as needed. As data rates increased, the bandwidth required exceeded the capability of the lines. Now, data quality is expected from voice grade lines, and the older cable plants cannot adequately support data communications. To resolve this problem, cable television companies are contracted to string coaxial cable, making our cabling-in-place records incomplete and inaccurate. The result is a severe operational and maintenance management problem.

Cable troughs and ceilings are full of communications cable, electrical wire, and fire and intrusion alarm system cables. Cross talk, radiation, and improper shielding are creating havoc for data communications.

The training programs and test equipment provided maintenance personnel cannot remain current because of the rapid advancements in automation technology. In addition, most base communications facilities do not have an automatic diagnostic capability for data circuits. Consequently, communications maintenance personnel stand by their telephone lines, as do the vendors their equipment, pointing fingers at each other. Meanwhile, the users sit by their darkened terminals wondering where to turn for help in resolving their communications problems. To help referee this problem and provide technical guidance in data communications projects, more personnel trained in computer communications are needed. One reason for the diversity and lack of interoperability of computer communications systems in the Air Force is the dependence upon vendors to determine requirements and provide a system to satisfy them. Skilled computer communications personnel, following a well-organized plan for data communications, can prevent these problems.

Communications security will continue to present problems to logisticians who need equipment in a hurry and want to provide easy access to terminals. Equipment is purchased for processing information in unclassified applications. Later on, classified processing and a TEMPEST test of the equipment are required. The equipment does not pass the test and must be replaced at great expense in time and money. The whole situation could have been prevented by selecting TEMPEST approved equipment. The Preferred Products List and lists of equipment and their emanation profile are provided by the Electronic Security Command to aid equipment purchasers in the selection of equipment that will process classified information.

New Technologies

Emerging technologies in commercial communications provide new methods of mass storage and instant access, using computer communications networks. Two recent developments with great potential for logistics support are videodiscs and videotext.

Conventional videodiscs have 15,000 tracks per radial inch. Using 4-bit quantization and an error probability of 10^{-10} , 10^{10} bits can be placed on a 30-minute disc. Improvements in density can produce a ten high 12-inch disc pack, placing 1.2 terabytes on-line on a single spindle. This would equal 10.8 million National Television Standards Committee (NTSC) standard television frames. It is notable that a band of only 100 tracks contains the equivalent memory capacity of a typical magnetic disc drive.

Videodisc technology is not expensive. Using optical scanning, a read-only-memory has a cost per bit of \$.00001. A master disc can be stamped from a tape recording for less than \$1,000, with replicated copies costing less than \$1 each.

Slow scan television transmission can be used to produce 2000 line by 2000 line high resolution pictures from engineering data stored in this form. This information may also be stored on an ordinary audiotape recorder for later use or display on a high resolution monitor or plotter. Using AUTOVON or other voice grade telephone lines, a frame of this information can be transmitted in 8 seconds.

A very interesting application is placing technical and maintenance manuals on videodisc. Using 10kHz-time compressed audio, 10 seconds of audio could accompany one frame of video, making possible a talking maintenance manual providing 27,000 full-color, still-frame pictures and 75 hours of audio commentary on one disc. Full motion video with normal audio could be mixed with the still pictures. A microcomputer costing less than \$200 can control a videodisc player with an inexpensive, commercially available interface. The ability of this system to access frames randomly and run still, slow, or full motion is well suited to locally programmable training, briefing, and maintenance applications. The video and audio presentations could then be saved on a videotape for further distribution. Spare parts listings and ordering information currently on microfiche could be transferred to videodisc, allowing use of the videodisc hardware for many purposes.

Another major development in computer communications information retrieval is videotext. IBM's entry in this market provides as many as 350,000 frames of information, each frame consisting of 24 rows of 40 character columns. An advantage of videotext over videodisc is the ability to update and edit information. Also, IBM's system provides 99 levels of security to protect classified and sensitive information. As with slow scan videodisc transmission, videotext can be broadcast at radiofrequencies or carried over voice grade telephone lines.

The National Broadcasting Company (NBC-TV) has indicated the state of this technology by announcing it would implement teletext, a form of one-way videotext, during 1983. The signal will accompany all the network's broadcasts, using the vertical blanking interval of the television waveform.

Expectations

Advancements in semiconductor manufacturing and miniaturization present new horizons for data

TO 26 ▶



CAREER AND PERSONNEL INFORMATION

Civilian Career Management **The People Versus the Job**

Those of us assigned to the Logistics Civilian Career Enhancement Program (LCCEP) management team count the fully mechanized processing of Promotion Evaluation Patterns (PEPs) among life's not-so-little miracles. The thought of a massive computer in the Air Force Manpower and Personnel Center (AFMPC) at Randolph AFB, Texas, matching the skills of a Weapons System Liaison Officer at Geilenkirchen AB, Germany, against the specific job requirements of a Supervisory Logistics Management Specialist in the new Consolidated Space Operations Center at Los Angeles Air Force Station seems a bit unreal. Yet this process is part of the daily routine of the LCCEP staff. That such complexity can be routine is a tribute to the many Air Force professionals involved in Logistics Career Management.

Any career management program starts with identification of the positions to be managed. In the LCCEP, these are pure logistics positions at the GS-12 level or above, or positions involving 50% or more logistics duties, which have been selected by the respective MAJCOMs for central management by the Logistics Career Program Branch in the Air Force Office of Civilian Personnel Operations (OCPO) at Randolph AFB. The selected logistics positions are identified in the base and Headquarters Air Force (HAF)-level data bases as centrally managed Career Executive positions.

The Position Description (PD) for each centrally managed position is furnished to the appropriate Program Administrator for that series; e.g., Supply, Transportation, Quality Assurance. After careful review, the PD is clustered with similar centrally managed positions. Clusters are further defined by a Work Group composed of functional management representatives and assisted by OCPO program managers. With jobs properly clustered, the Work Group determines the major job requirements and the knowledges, skills, and abilities (KSAs) required to accomplish them. KSAs are carefully weighed to reflect the importance of each to the clustered jobs. This important task is completed by matrixing these KSAs with skills codes representing sources of such experience to determine the most qualifying experience for the positions to be filled. This rigorous process assures that the PEP meets validation criteria of job relatedness required by the Uniform Selection Guidelines. PEP data is translated into specific skill codes, grade(s), length of service, and other requirements, and is entered into a program called "MERIT" in the HAF-level host computer. It will remain there ready for immediate summons to support requests to fill jobs within the cluster. If the PEP is constructed correctly and validated properly, changes cannot be supported. Errors in the original validation or changes in the job characteristics are the only legitimate reason for change. However, LCCEP PEPs may be reviewed by anyone. To facilitate

such review, all stored PEPs are periodically reproduced on microfiche and distributed worldwide for ready reference.

With position requirements carefully documented and stored in the computer, a brief look at "people records" is in order. The Personnel Data System-Civilian (PDS-C) is the computer storage program for detailed records on all Air Force civilian employees. At the end of Jun 83, the data base contained 291,423 records, of which 34,157 described logisticians. These records include a comprehensive profile of each employee, including skill codes, length of service, and other elements which express the employee's job history. This record is screened against the corresponding skill requirements stored in the PEP to determine the relative qualifications of each individual for centrally managed positions.

In practice, the HAF-level PEP initially considers everyone when it narrows the list of candidates from the 290,000 plus records in the data base, to those registered in the LCCEP, and then to those few best qualified from whom 10 candidates will be referred for promotion consideration, with a second list reflecting competitively selected candidates for lateral reassignment and/or change-to-lower grade.

Routine or miracle, since the inception of LCCEP in 1980, this system has merged the validated job requirement in over 500 cases with the best-qualified candidates in the Air Force. The system is working; give it a chance if you have not.

Source: Edward S. Wright, OCPO/MPKCL

Military Career Management **Why AFIT for Logistics Officers?**

Supervisors in maintenance, transportation, and supply often voice a common concern to our AFMPC logistics resource managers about the loss of officers to the Air Force Institute of Technology (AFIT) program. Their feelings range from passive acceptance to total disdain for any program that removes a young officer, filling a critical position, from an operational unit for the 15-month school year.

A typical argument one hears is that it does not take a master's degree to make a good logistician, maintainer, transporter, or supply officer. If this is true, then why continue to support or push Air Force goals for higher education? First, we must examine the process that creates an Air Force need for an advanced academic degree (AAD). The unit manning document (UMD) or manpower rosters list authorizations identified with codes such as 1AMY, 1AMJ, 1AMM, 1AMT, or 1AMS. These indicate the need for a master's degree, with a *specific* degree corresponding to each code. The positions are all identified by officers who previously held the jobs. They believed a

Contracting for Reliability

Earl T. Steiner

Procurement Analyst

Hq Air Force Acquisition Logistics Division (AFLC)

Wright-Patterson AFB, Ohio 45433

Introduction

Program managers have tended to think of performance in terms of speed, firepower, or turning capability. Problems associated with availability were not adequately studied until after the weapon system was fielded. By then the program manager was transferred and the program office closed. Miracle warranties and guarantees were developed to provide for reliability, availability, and maintainability (RAM), but never quite got the job done. Supportability of a system is part of the total performance package and must be planned for early in the conception phase.

Reliability Improvement Warranty

A program manager must consider alternatives when deciding whether to use a reliability improvement warranty (RIW). The following observations were made after reviewing different RIW provisions, some of which had been studied by the warranty improvement center; reviewing material from the Air Force lessons learned data bank; and discussing items with the managers and the Air Force Logistics Command office that tracks RIW performance.

Reliability, availability, and maintainability must be part of the required performance envelope of a system. A system with super performance capabilities is not worth much if it is not dependable. In the development of any system, trade-offs are made between operational performance and the costs of development, production, operation, and maintenance. A good system is one based on the proper compromise between these factors. This would result in a system that dependably performs its required mission at a low life cycle cost.

The following quote from the F-100 engine lessons learned lends credence:

The Component Improvement Program (CIP), fleet retrofit, and extensive maintenance are accomplished at tremendous costs and have driven the search for remedies to include warranties. However, warranties do not necessarily increase reliability. The developmental environment testing needs to be a serious effort to catch design problems early. The policy of buying an inadequate engine in hopes of improving and changing the system later has resulted in increased costs. Assuming a 15-year life span, Component Improvement Programs (CIP) conducted during the engine's operational life can cost as much as it did to develop the engine to its initial 150 hour Model Qualification Test.

This supports the maxim that it is easier and cheaper to design in and build in reliability than it is to engineer it in during and after production. On the ARC-186 radio, for example, the approach was to test each radio for reliability prior to acceptance. This test consisted of heat cycles and vibration cycles which resulted in a radio with a mean-time-between-failure (MTBF) in excess of 2000 hours. In any program, the managers must determine whether the required

RAM can better be obtained through guarantees, an RIW, or a combination of these.

An RIW is only one method that can be used to increase a system's reliability and, along with other associated contract provisions, must be structured with great care to achieve increased reliability. It is very possible that an RIW may only result in a system whose repairs are cheap, easy, and quick to make. An ideal RIW is one that would cause the contractor to have no direct warranty cost because no system failures occurred.

To be effective, contractors must know during a system's conception and design if either an RIW or RAM guarantee, or both, will be in the production contract. It is during the design phase that the limits of a system's RAM are determined. As in the previous example, it is cheaper, easier, and faster to design in high RAM than to add it later through engineering changes. Some of the guarantees that must be considered, whether or not the production contract contains an RIW, are:

(1) A high mean-time-between-failure (MTBF) guarantee. If the MTBF is high enough, few or no system failures would occur. The cost of obtaining a high MTBF must be balanced against the cost of remedial maintenance. To obtain a high MTBF in a system may require a large amount of preventive maintenance.

(2) A high mean-time-between-maintenance (MTBM) guarantee. A system that requires little or no preventive maintenance is desirable.

(3) A low mean-time-to-repair (MTTR) guarantee. The MTTR guarantee must apply to each level of maintenance where spares will be incorporated into the system.

An RIW contemplates that there will be engineering change proposals (ECPs) from the contractor which will increase the RAM of the covered system. The contractor usually proposes ECPs for two purposes: to meet performance or RAM guarantees in the contract and to decrease total costs of performing the contract. The handling of the ECPs could be critical to the success of the RIW.

(1) Without proper guarantees in the contract, an RIW may result in a system that is relatively inexpensive to build and repair but with low MTBF and availability. To protect his profit position, the contractor must balance cost of repair versus the cost of design and production. The ECPs from the contractor will decrease his cost of repair or meet guarantee(s) in the contract. Once he has met the guarantee, the contractor will only be interested in an ECP if it decreases his total cost of the RIW. The total cost to the contractor will include the change in cost of repairs and cost to implement the ECP. Cost of implementing an ECP includes retrofit kits for systems already produced if the contractor is required to do this at no additional cost to the government.

(2) To protect his profits, it is not likely that a contractor will propose an ECP when a large percentage of systems have been produced and where the contract requires no-cost retrofit

kits at no additional cost to the government. The RIW should require these no-cost retrofit kits only when the system has not met the required performance or guarantees. The contractor has no incentive to propose ECPs in the case where performance and RAM guarantees have been met and ECPs and retrofit kits are at no additional cost to the government. Where the performance or guarantees have been met, the ECP and retrofit kits should be at the government's option and be paid for by the government. One of the results of not doing this will be proposed changes after production and the expiration of the RIW period.

(3) The writer of an RIW should consider the use of a varied method of configuration/ECP control. Appendix G of the Defense Acquisition Regulation states that "it is the policy of the Department of Defense that the contractor should be given the maximum responsibility and authority for the performance of assigned tasks." When the government retains ECP and configuration control, it retains the responsibility for the total system performance. The ECPs referred to here are those that do not change the form, fit, or function of the system. Some managers reason that allowing the contractor to retain ECP control will result in an increase in the number of parts the Air Force must stock. If a part already stocked is causing the system to not meet its performance or RAM requirements, then it should be replaced. Also, consideration should be given to replacing that part in other systems. Only after the Air Force provisions a system does replacement of a part become a problem. As a result, the contractor should retain ECP configuration control until provisioning occurs.

RIW and other warranty provisions provide that certain damaged items do not fall under the warranty. Most provide for repair under a separate contract. A contract with an RIW should have a line item for repair of items not covered by the warranty. The provision covering this would be similar to an over and above provision setting forth hourly rates by fiscal-year periods. Usually RIWs are included in competitively awarded contracts. The time to establish repair rates is during competition.

To obtain the expected results from an RIW, the contract should contain an incentive for performance of the RIW. The RIW part of the contract would be a firm-fixed price with an incentive fee. Some of the methods for setting the incentive fee could be:

(1) The fee would be paid in some inverse proportion to what the actual contractor's total cost of the warranty is compared to the proposed/projected/targeted total cost. If no costs were incurred, the contractor would receive a fee twice the target fee. If the incurred costs are twice the target costs, the contractor would receive no fee.

(2) The fee could vary based on the number of units returned for repair compared to the number of installed units. This would give an approximate measurement of the MTBF.

(3) The fee could vary based on the average cost to repair returned units. This approximates the mean cost of unit repair.

(4) The fee could vary based on the total cost of warranty repair divided by the number of installed units. This approximates the mean cost of repair.

For items that have an elapsed time indicator (ETI), failure of the ETI should be considered a system failure. If an item has been returned for repair and tests good, it should be considered a failed item when the intermediate or line peculiar support equipment and contractor established test procedures indicate it is bad.

When the equipment is to be used in more than one type of aircraft, the required MTBF should vary for each type. A radio that would experience a 4000-hour MTBF in the C-5A would probably have less than a 1000-hour MTBF in the A-10. In the case where a mix of planes will use an item, different charges for RIW should be incorporated. Where a single amount is charged for RIW, per item, and only one MTBF is required, the RIW should contain a mechanism to change these based on experienced use by airplane time compared to projected use.

A multiple sensitivity analysis *must* be performed on all incentives and formulas in the RIW. Each should be examined individually and then the results of their interaction studied. The combined effect may not be the incentive we want.

One problem that can accompany an RIW is that the money to transition from RIW to organic repair may have disappeared from the budget before transition takes place.

It is possible that some faults may be hard to identify or repair. The contractor could have a tendency to ignore these and concentrate on those quick and easy to repair. To preclude this, the turnaround time (TAT) guarantee should cover not only the average TAT but the maximum TAT per unit. If the contractor cannot meet the maximum, he should supply a consignment spare.

Summary

An RIW provision will result in a contractor following the course that is to his best interest. The RIW must be carefully designed so that the best interest of the contractor coincides with the best interest of the government. It is not easy to determine the effect an RIW with multiple incentives will have, which is why it is essential to do multiple sensitivity analysis of the incentives. A well-designed acceptance testing (such as "burn-in") may result in better RAM than an RIW and be less expensive to the government. Because of the costs of redesign and retrofit, RAM testing during development can be expected to be more effective than the same money expended under an RIW. If the contractor is to be held responsible for results, he must control configuration as long as the form-fit and functions of the item are retained.



"The American World War Crusades reflected the militant Calvinism of the frontier Rifleman, Quaker pragmatism, and Cavalier ideas of honor. The American professional soldier did what his society wanted him to do as well as any professional military man in history."

Theodore Ropp, "Armed Forces and Society: Some Hypotheses" in *New Dimensions in Military History*, ed. by Russell F. Weigley.

How Much Do We Need? - What Do We Take? A Tool To Help—Now!

Dr. Thomas W. Gage
Mathematical Statistician
Air Force Logistics Management Center
Gunter AFS, Alabama 36114

Captain Andrew J. Ogan, USAF
Supply Systems Analyst
Air Force Logistics Management Center
Gunter AFS, Alabama 36114

Introduction

For every exercise or deployment, there are a number of lingering questions. Do I have enough stocks to support the mission? What happens if the maintenance concept changes? What happens if airlift changes? What can I afford to leave behind? At base level, where these decisions are made, there is little to go on but past experience, yet each deployment or exercise seems to inevitably provide special or unique requirements.

Typically, we prepare for these events through a committee composed of supply, maintenance, transportation, and logistics plans representatives, charged to determine what must be done to support the mission. This exercise usually includes an item-by-item review of the critical spares (such as the war readiness spares kit (WRSK) assets) to determine how much is available and what actions can be taken to resolve any projected shortfalls.

Despite this careful planning, however, there are usually a number of last-minute changes that totally alter the concept of the specific deployment or particular exercise. The number of aircraft involved, the amount of airlift available, or the type of maintenance or resupply concept can be, and usually is, changed at the last possible moment. The base is then left to fend for itself, making, at best, blind guesses as to what is really needed to meet mission needs.

At the Air Force Logistics Management Center (AFLMC), we have been especially concerned about this problem. A tool which looked at critical assets was therefore absolutely necessary. With the advent of capability assessment models, tools to provide this type of analysis became available. However, only with the most recent development of the miniature Dyna-METRIC (MINDM) model at the AFLMC has this capability been geared specifically for general base-level use.

We will explain this valuable model in some detail and will include a review of the necessary inputs, available outputs, and possible applications. But, first, we will describe, in a basic overview, the model and its capabilities.

Model Overview

The MINDM is an exciting capability assessment tool. It is designed to take information concerning proposed operational scenarios and logistics resources (in this case spares and maintenance repair capabilities) and then provide output in the form of *expected* operational performance based on an evaluation of those logistics constraints.

The goal in the development of this system was to devise a tool that was simple to use, yet flexible in the variety of scenarios (both operational and logistical) that could be

employed and evaluated. There are, in fact, only a handful of necessary inputs, and many can be adjusted or varied on a day-by-day basis if desired. By making the system simple, yet flexible, base-level managers can evaluate a number of "what if" scenarios including, but not limited to, the types of questions posed at the outset of this article.

Because this model was simplified for base-level use, there are some necessary limitations. The model has been designed to run on a microcomputer—the Cromemco in particular. It is programmed in FORTRAN IV which makes it exportable to other types of microcomputers. Because of microcomputer limitations, the model cannot look at the wide range of assets as one might do on a large mainframe computer such as Phase IV. However, to compensate for those limitations, a number of innovations have been developed which enlarge the analysis area covered by the model. It can, for instance, look at up to 1,000 parts and 90 aircraft for as long as 120 consecutive days of exercise or deployment. During this entire time, the operational, maintenance, and supply/resupply concepts can be adjusted any number of times to meet various exigencies.

The model, then, has been programmed to facilitate ease of processing. To make a program run, the user merely types in the name of the program. After that entry, the model takes over and prompts the operator through the remaining steps. All that will be asked of you is to provide the input files (for both the operational and parts information) and the output file names. Once this information is provided, the model will sift through the input files and write to the output files. The next two sections will describe each of these areas.

Model Inputs

The model inputs are fairly straightforward. The inputs to this model are taken from data files that the user loads. A key point to remember is that the inputs are designed to provide the user the maximum flexibility. The informational requirements themselves fall into two categories: operational or scenario inputs and parts inputs.

The operational inputs (Figure 1) are those describing the flying program that is to be evaluated. There are four pieces of information that must be collected: number of aircraft, desired number of sorties per aircraft per day, flying hours per sortie per day, and the maximum number of sorties that can be flown by each aircraft each day. Any and all of these entries can be varied on a day-by-day basis to reflect changing sortie requirements, aircraft deployments, or force employment. These inputs reflect your requirements. From an interpretation of them, the model will compute the actual flying program that can be supported.

The parts information is somewhat more elaborate. Figure 2, for example, provides a file layout for one part. The first

SCENARIO FILE LAYOUT

LINE 1	SCENARIO LABEL (28CC)				
LINE 2	NUMBER OF DAYS (3CC)				
LINE 3	DAY (3CC)	NR OF ACFT (3CC)	REQUESTED SORTIES (5CC)	MAX SORTIES (5CC)	FLY HR/ SORTIE (5CC)

Figure 1.

line contains the part name, quantity per aircraft (QPA), awaiting parts (AWP) time, fractional AWP (or the percent of time the part goes into AWP), and the demands per flying hour, or failure rate (FAILR). The second line contains the day of the exercise, base repair cycle time, percent of base repair, order and ship time (or resupply time), and stock. Any inputs on this second line can be altered on subsequent days of the exercise to reflect changes in repair, order and ship time, or stock levels.

LRU FILE LAYOUT

LINE 1	PART NAME (20CC)	QPA (3CC)	AWP (5CC)	FAWP (4CC)	FAILR (7CC)
LINE 2	DAY (3CC)	BRT (5CC)	PBR (4CC)	OST (5CC)	STK (3CC)
LAST LINE	999 (3CC)				

Figure 2.

Model Outputs

Armed with these inputs, MINDM can calculate the expected performance of a unit. This is valuable information which is based upon two major files that are created with each model run: operational information and parts information.

The operational information consists of the expected fully mission capable (FMC) aircraft and the expected sorties to be flown for each day. The information is presented in tabular form and can easily be transferred to graphs if that capability is present on your microcomputer.

The parts information is more elaborate. The user may pull out all the parts information or select only a range of parts for analysis. Whatever the selection, the system will provide the user specific consumption information on all or selected parts for each day of the scenario (Figure 3). The categories of information are fairly explicit and designed to facilitate problem solving. Under each day, the problem part is identified. The pertinent consumption information consists of the expected on-hand (EOH) values, the expected back orders (EBO), the input stockage of each day (STK), and the distribution of the broken parts (the last three columns). Broken parts may be in base repair (BAS), in the order and ship time pipeline (OST), or in AWP waiting for subcomponents.

PARTS OUTPUT FILE

PROBLEM PARTS						
DAY 0	EOH	EBO	STK	BAS	OST	AWP
DAY 1	EOH	EBO	STK	BAS	OST	AWP
DAY 2 5895001688798	EOH -3.5	EBO 3.5	STK 0	BAS 3.4	OST .1	AWP 0.0
DAY 3 5895001688798	EOH -4.7	EBO 4.7	STK 0	BAS 4.5	OST .2	AWP 0.0
DAY 4 5895001688798	EOH -5.6	EBO 5.6	STK 0	BAS 5.3	OST .3	AWP 0.0
DAY 5 5895001688798	EOH -6.3	EBO 6.3	STK 0	BAS 5.9	OST .5	AWP 0.0
DAY 6 1430005072656 5895001688798	EOH -3.3 -6.9	EBO 3.4 6.9	STK 1 0	BAS 1.7 6.3	OST 2.7 .6	AWP 0.0 0.0
DAY 7 1430005072656 5895001688798 6105002620432	EOH -3.8 -7.3 -3.0	EBO 3.8 7.3 3.0	STK 1 0 0	BAS 1.7 6.6 0.0	OST 3.1 .7 3.0	AWP 0.0 0.0 0.0
DAY 8 1430005072656 5895001688798 6105002620432	EOH -4.3 -7.7 -3.3	EBO 4.3 7.7 3.3	STK 1 0 0	BAS 1.7 6.8 0.0	OST 3.6 .9 3.3	AWP 0.0 0.0 0.0
DAY 9 1430005072656 5895001688798 6105002620432	EOH -4.7 -8.1 -3.7	EBO 4.7 8.1 3.7	STK 1 0 0	BAS 1.7 7.0 0.0	OST 4.0 1.0 3.7	AWP 0.0 0.0 0.0
DAY 10 1430005072656 5895001688798 6105002620432	EOH -5.1 -8.3 -4.0	EBO 5.1 8.3 4.0	STK 1 0 0	BAS 1.7 7.1 0.0	OST 4.4 1.2 4.0	AWP 0.0 0.0 0.0

Figure 3.

MINDM Applications

After examining the inputs and outputs of this model, we now know that we have a vulnerable management tool which allows the user to ask a number of "what if" questions—and get answers quickly. It also allows him to vary a number of inputs to determine the impacts on the operational scenario. In this section, we are going to review some of the uses of the model—and perhaps provide some insights concerning those questions we raised at the outset of this article.

Incremental Support

The model allows incremental or decremental support in maintenance and supply. The repair cycle time, percent of base repair, and the stockage can all be adjusted individually or together for each part—for as many times as desired over the deployment. In this manner, the base-level manager can look at the effects of taking no repair or no stock as well as the impacts of time-phased deployments of each. And, since the information is determined by part, specific types of maintenance can be evaluated—including the necessity of certain categories of maintenance equipment.

We know that resupply tends to cluster around certain days. That is, resupply is not a continuous process. We can only resupply assets on certain days. Many wartime scenarios use a 23-day resupply time—airlift and assets should be available to the unit on the 23rd day of the exercise, but not before that time. However, few models enable you to observe the impacts of that policy. With this model, the receipt of parts can be clustered about any time period desired by the user. The inputs may be set on the order and ship time input to reflect no receipts until the time specified by the user. In this manner, the base-level manager can determine the best resupply policy to meet his needs.

Air Base Attack

A number of scenarios recognize the possibility—even probability—of an attack on the host base. Using this model, the impacts of such an attack on the ability of the maintenance and supply personnel to generate FMC aircraft can be evaluated. In a logistics model, there are several key consequences of a direct air base attack. We can lose stock, we can lose repair (through loss of equipment, personnel, or both), or we can lose aircraft.

All these categories can be adjusted on a day-by-day basis to allow for base attack contingencies. The discussion of incremental support described how the repair capability and stockage could be adjusted (both upwards and downwards). The operational information can be similarly adjusted to reflect losses of aircraft. Depending on the severity of the attack, the impact on the logistics resources can be identified and evaluated and, in turn, acted upon.

Variable Consumption

Depending on the mission and location of an exercise or deployment, the consumption of parts may vary significantly.

FROM 20

communications. Transmission media and services are being developed to explore those horizons.

"Logistics data communications using satellite transmission will increase steadily for the next 10 years. . . ."

Logistics data communications using satellite transmission will increase steadily for the next 10 years and then will level off as fiber optic trunking replaces metallic data circuits.

Packet-switching networks will increase as they gain the capability to support remote job entry terminals. Packet-switched encrypted voice service will be introduced on the Defense Data Network for military command and control.

The current capability within the AFLC of providing managers with instant report generation and access to data

A poorly constructed runway may translate into a higher failure rate for landing gears. With this model as a management tool, the failure rates can be adjusted to reflect anticipated increases in broken parts. In addition, the impacts on the repair process can be analyzed to determine the possible need for additional repair or parts.

Conclusion

The MINDM is a valuable management tool with virtually unlimited applications at base level. We have programmed it for a microcomputer to make it readily accessible to a wide range of users. The inputs are simple, yet flexible, and allow a great deal of latitude in management uses.

The flexibility is such that those questions raised at the outset can be answered quickly and accurately. How much stock will be consumed in any operational scenario can be quickly projected by the model. With that information, asset requirements for a specific operation can be identified. Changes in management and maintenance policies can be readily evaluated. And, immediate questions concerning assets and maintenance capability—whether to take or leave behind—can be quickly resolved.

This model is, however, only a tool. While it can provide answers, the quality of those answers depends on the accuracy of the input. The variability of the inputs enables managers to look at a number of contingencies. But, the model will not take the place of the manager in the final analysis—it will only serve as an important tool to help good management.

If you are interested in using this model at your activity, or have any questions regarding this article, please contact AFLMC/LGS, AUTOVON: 446-4165.



bases, word processing, and other networks from one terminal will increase as the DOD moves toward distributed data processing. Networks will be considered sources of information rather than just communications vehicles.

Man-machine interfaces will be improved, with telephone voice access to distant computers and synthesized voice response.

Aircraft will be equipped with automatic diagnostic capability, providing technicians with access to diagnostic mainframes through radio modems. Aircraft maintenance records and technical manuals will be updated automatically and retrieved through hand-held terminals.

The video game craze will find fruition in a new generation of computer-literate Air Force members, able to accept the challenge of new, highly sophisticated weapon and information systems.



"At the tactical level, a very similar point applied. The Russians were attempting to apply a battle-fighting method which demanded a degree of independence in junior leaders which it had been a major interest of the Marxist-Leninist system to discourage."

General Sir John Winthrop Hackett in *The Third World War*, August 1985.

Logistics Realism in Exercises

Lieutenant Colonel Ronald D. Hoover, USAF
Munitions Program Manager
Security Assistance Programs for Saudi Arabia
HQ USAF, Washington, D.C. 20330

Abstract

Military training progresses from "basic" fundamentals to mock wars with the goal of gaining and maintaining the highest degree of military proficiency possible. A requisite ingredient for achieving this objective is exercise realism.

If an exercise is not realistic, the benefit of practice in real world application is diluted. The problem which arises when exercising a military combat capability is not so widespread and United States (US) military forces are not involved continuously. As a result, the various services and major commands develop exercises which range from large-scale, joint service, international field training exercises in Europe to small, isolated, procedural command post exercises. The full spectrum of exercises is developed to train personnel at various levels in the wartime functions.

At times, the overlapping exercise schedules of various agencies tend to involve the same people. Before any lessons learned can be applied to improve procedures or techniques, another exercise is underway again with the old methods. At times, these become so overtasked with exercise play and Operation Plan (OPlan) development that other necessary functions suffer. In other exercises, the objectives of the exercise become the demonstration of greater capability than the participants really have. Both the frequent and the "make it happen" exercises are unrealistic logistically.

This paper describes some examples of what should be considered as specific exercise objectives for logistics realism and proposes basic improvements needed for the current exercise programs.

Introduction

The need for military exercises is much the same as is practice for a competitive sports team. If a team wants to perform well in an upcoming game or season, experience shows that the team which learns the skills, along with the techniques for best applying those skills, usually becomes a winner. In other words, the practice program which prepares the team deserves a great deal of credit in gaining that team competitive victories. Military exercise programs are intended to have similar results, but the game of war indeed does not have rules as clear-cut and defined as football. The military team must be prepared to compete in almost any level of conflict, from a closely limited contingency to a general nuclear war.

The spectrum of potential military applications is so vast that continuous practice for each level is impossible. Instead, the philosophy of preparing for the worst situation is often applied to exercise training in support of a particular theater war plan. Unfortunately, major OPlans, such as EUCOM OPlan 4102 or RDJTF OPlan 1003, are so large and complex that applicable exercise scenarios must be scaled down, at least in the level of detail played. In the process of reducing a major OPlan to a manageable exercise, logistics realism, more so than operations realism, is often sacrificed.

This lost realism is usually unintentional or unavoidable since a true test of logistics support might require at least 30 days' activity to evaluate the adequacy of any planned resupply. Other key exercise areas also frequently suffer from artificialities which could and should be avoided. Too often, preconceived ideas to promote the success of a new operational concept or weapon system give reviewers a false impression about the capabilities of the "logistics tail" of the military. A sterling example of this was demonstrated in the early days of the F-15 when a seemingly magical and endless supply of missiles was introduced in exercise starting positions when the actual inventory was in fact extremely low.

What then is logistics realism? It is the application of truthful planning factors for the situation described in the exercise scenario. The following are a few examples of what should be addressed in detail during exercise planning and strictly enforced throughout exercise play.

- Attrition (aircraft, people, facilities, and equipment).
- Munitions and spare parts inventory (detailed tracking of selected critical items).
- Maintenance turn times (no magic during peak activity).
- Chemical environment operations (requirements, equipment availability, and adequacy).

Every attempt should be made at all levels to plan exercises with honest approximations of the situation so the team will not be flown off the field because it underestimated the opponent or overestimated its own capability.

Lessons From the Past

In previous exercises, several deficiencies have been identified, such as the critical airlift shortfall which was highlighted through NIFTY NUGGET '78. That problem provides a perfect example of the importance of logistics realism in exercises. Four years after that highly publicized exercise finding, the airlift shortfall is still critical and the resolution path is still not agreed upon and mapped out.¹

Another NIFTY NUGGET '78 finding has seen quicker action. The Joint Deployment Agency (JDA) has been created to "bridge the gap" between the senior management flexible option development requirements and the mass of inflexible data that lies in the planning and execution system. The JDA has been well-employed in its short life, but PROUD SPIRIT '80 and POLL STATION '81 again found the plans execution system incapable of providing decision makers the information they required.² This problem highlights the complexity of planning and coordinating the execution of a joint service operation, using a very general approach to accommodate a preplanned exercise scenario. Imagine the complexity of

identifying and resolving the myriad of details which would arise in an actual execution of a major OPlan.

If organizations, procedures, and communication capabilities evolve in a positive manner, an exercise will serve to promote interaction among supporting and supported commands and services. The exercise environment can be conducive to identification of problems and alternative approaches to resolution. These cooperative efforts can have direct application to refinement of OPlans exercised, but only if the scenario, assumptions, and planning factors in the exercise are the same as those in the OPlan.

Another topic which has been identified as a problem in previous exercises is the mobilization of Air Reserve Forces. Considerable attention has gone into the modernization of weapon systems and the use of Air Reserve Forces in exercises and deployments. Still, peacetime organization structure and work schedule differences preclude full appraisal of integrated forces contained in OPlans assuming mobilization of Air Reserve Forces. One of the findings in Exercise PROUD SPIRIT was a seemingly continuing failure of high-level civilian agency executives to be interested in their mobilization roles.³

Perhaps the failure to resolve all those deficiencies in earlier exercises is attributed somewhat to the lack of an available US industrial base capability to provide responsive support to a major conventional war effort. Over recent years, there were economic conditions and pressures to build and field new weapon systems before a full logistics support capability could be secured. Currently, because of this eagerness, the Air Force has several aircraft which require contract support. Most of these aircraft have systems with critical mission system spare component shortages which result in a dependency on a source outside the military system. This type situation obviously presents unique readiness and sustainability problems. Combat units must rely on companies and people who may feel no pressure or obligation to respond to Air Force preparation for combat.⁴ Furthermore, even sources within the government, such as the General Services Administration (GSA), could possibly hinder efforts by the Department of Defense to obtain assets which are available only through their agency. This lack of direct control could have a devastating impact on combat capability by delaying availability of critical resources.

The major problem areas mentioned are just a few that have been highlighted by past exercises even when the treatment of most logistics issues has been superficial. The magnitude of the real problems yet to be discovered is no doubt awesome. Some perhaps may not be as critical as the current airlift shortfall or the need for the JDA, but the opportunity for refinement of prepositioning, host nation support, or joint use requirements is a gold mine of problem areas that remains virtually untapped.

Challenge of the Future

The formidable task ahead then is to use complementary planning and exercise programs. Since the Rapid Deployment Joint Task Force (RDJTF) was formed in response to the volatile situation in Southwest Asia, all unified commands have produced an increased number of OPlans. The supporting commands have been flooded with requirements for more plans and exercises. Quality versus quantity must soon be addressed. Exercise planning is beginning to suffer because the plans to be exercised are rapidly becoming out-of-date

because the planners themselves have been wrapped up in exercise planning—and, so, the endless cycle goes. A schedule of fewer, better organized exercises is overdue.

A feature of future exercises is the multi-plan or no-plan scenario. Such exercises address the probable requirement for the US to respond to simultaneous contingencies. An assumption such as this can essentially negate all logistics planning which has been accomplished for one, two, or all OPlans considered for simultaneous implementation, since each may have been based on one war at a time. On the other hand, planning accomplished under the assumption of simultaneous implementation could generally be readily adapted to execution of only one of the candidate plans. If the probability of multiple OPlan execution is what the Joint Chiefs of Staff (JCS) realistically contemplate, planning assumptions should be adjusted so accurate logistics requirements can be identified and obtained before they are needed.

Logistics planning for a major contingency requires a long lead time. The needed resources range from peacetime operating stocks through Air Force Logistics Command (AFLC) depot assets to stocks from vendors who have the capability to manufacture the required items. In addition, the complexity of the process of locating, funding, manufacturing, and delivering critical parts to an overseas theater is not appreciated by most military personnel, let alone John Q. Public.

Many of the tough basic questions about the unit combat capability must be addressed head-on. Is the Unit Readiness Report (UNITREP) accurately responding to information requested by the Joint Chiefs of Staff? Does the JCS recognize that information available to the reporting unit is only part of the story and that status of employment base posture is equally critical to the combat rating of the deploying unit? The exercises of the future can and should be designed to address the difficulty of obtaining information which provides accurate combat capability estimates.

For instance, chemical warfare defense operations to protect our personnel and materiel resources have been virtually dismissed as too hard, too distasteful, or too awkward to address realistically in the past. True, some overseas units do practice wearing gas masks and do exercise token activity in the chemical defense ensemble, but the real seriousness of unit combat capability degradation has not really been confronted. The only apparent progress in this arena is in the implementation of the push delivery system of obsolete items for type C (chemical defense) mobility bags.

While the recent acquisition of new weapon systems, such as the F-15 and F-16, has enhanced the US wartime capability, other still active weapon systems are over 25 years old. The capability of those aging systems to employ effectively against new enemy technologies is becoming more and more questionable. The support of these older systems also becomes increasingly more difficult. Problems range from the expected deteriorating performance to a greatly depleted source of spare components resulting from no current industrial base production.

Conclusions

There is no doubt that this bleak picture of our future can be turned around; however, it is absolutely imperative that problems be addressed in a straightforward manner. Our country is a democracy which on occasion has had to call upon

its military to deal with an international conflict. A professional approach to planning and exercising the military community to maintain national credibility must be the avenue to meet new challenges.

The world of military logistics is fascinating, complicated, frustrating, and ultimately rewarding. It is a lucrative field for today's PROJECT WARRIOR to "identify ways to improve the war-fighting spirit and perspective of Air Force people, and encourage an improved understanding of the theory and practice of war, with particular emphasis on the contribution of air power to help plan better for the future."⁵

The difficult task of incorporating logistics realism in exercises will pay dividends by improved planning. Insight gained in the exercise environment will open new ways to resolve problems and provide justification to obtain funds required for additional resources. The following ideas are proposed as basic improvements needed for the current exercise program:

- (1) Expand senior management awareness of criticality of realistic logistics exercise activity.
- (2) Increase the limited cadre of logistics planners who have knowledge of the Joint Operations Planning System (JOPS), the Joint Development System (JDS), time-phased force deployment data (TPFDD) development, the Program Objective Memorandum (POM) cycle, and the interrelationship among functional areas. This requires a long-term effort of recruiting and educating more qualified logisticians.

- (3) Establish an active exercise management organization at HQ USAF level to focus on logistics aspects. An Air Force regulation should be published, HQ USAF must work with JCS/J4 to have early logistics involvement in exercise planning, and Master Scenario and Events List (MSEL) inputs should be specifically related to exercise objectives.
- (4) Eliminate current exercise magic and success-assured planning. This provides a false sense of security in areas where serious problems exist.
- (5) Develop methods such as negative balance tracking to focus attention on deficiencies without terminating exercise play for other functional areas.
- (6) Establish exercise environment which requires participants to use alternative means of accomplishing tasks. Need generates ingenuity and creativity.
- (7) Systematically track lessons learned and corrective action status to avoid repeating the same mistakes.
- (8) Have fewer exercises of better quality.

Notes

¹Berry, F. Clifton, Jr. "The Airlift Tragedy," *Air Force Magazine*, August 1982, p. 4.
²Gast, Philip C. (Lt Gen, USAF). "Joint Planning and Execution Steering Committee (JPESC)," Joint Chiefs of Staff Memorandum, 30 Jul 81.
³Catlin, Benjamin S. "Mobilization is Flexible," *Air Force Magazine*, October 1981, pp. 45-49.
⁴Poe, Bryce, II (Gen, USAF). "Keeping Our Logistics Capabilities Out of Check," an article prepared for the AWC Associate Programs, ATC, Maxwell AFB AL, December 1980.
⁵Berry, "Project Warrior," *Air Force Magazine*, August 1982, p. 56.



FROM 21

real need existed for special skills in analysis, problem-solving techniques, and management.

These requirements are then reviewed by the chain of command for validity, purpose, and consistency. When approved, the position and AAD requirement are passed to the manpower experts who formalize the product and code the affected authorizations. The numbers are small when compared to the following total force requirements:

	Authorized	AAD Requirements
Maintenance	3,472	150
Supply	1,270	202
Transportation	1,030	160
Logistics Plans	1,080	130

After identification, the next step is to qualify individual officers and assign them against the proper requirements.

Officers selected for entry into AFIT follow a rigorous screening process. First, they must be volunteers who have obtained scholastic

acceptance through AFIT, scored significantly high on one of the graduate entrance exams, and been selected by a board at AFMPC. Several years later, these officers graduate with an education designed to enhance their ability to analyze, design, and manage complex defense systems throughout the Department of Defense.

Approximately six months prior to the September graduation date, worldwide requirements are analyzed and fill actions are initiated. The first axiom is that all AFIT graduates must be assigned against valid AAD billets. The resource managers on the logistics teams must ensure this is accomplished. A few of the prime users of AFIT graduates are the MAJCOM headquarters, certain separate operating agencies (SOAs), the Air Force Logistics Management Center (AFLMC) at Gunter AFS, and a few billets at wing levels.

These graduate programs are designed to increase the Air Force's technological base as well as advance the individual officer's career. The AFIT program builds a cadre of officers equipped to meet the technological needs of today and tomorrow. These programs are well worth the investment if in fact our war-fighting capability does depend on our technological lead. We think it does.

Item of Interest
SOLE Management Award

Each year the Society of Logistics Engineers (SOLE) authorizes the School of Systems and Logistics, Air Force Institute of Technology, to select one graduating student for the SOLE Management Award. This year's winner was Captain Richard J. Loewenhagen who was a Distinguished Graduate. He received the significant SOLE certificate of award and a three-year membership in the Society. In addition, his name will be permanently displayed on the SOLE Management Award plaque at the school.



CURRENT RESEARCH

Air University Logistics Research in the PME Classes of 1982-83

The logistics related research papers and projects completed by the students of Air War College and Air Command and Staff College during the 1982-83 academic year are identified below.

The Society of Logistics Engineers (SOLE) Logistics Award was presented in the Air War College to Col Steven T. Powers for his paper, "An Evaluation of the Effects of Design Decisions on Weapon System Performance," and in Air Command and Staff College to Major Richard G. Poff for his paper on "Proposed European Distribution System (EDS)—Is There a Better Approach?"

Air War College

"Air Refueling for Strategic Airlift—When? Where? How Much?"—Lt Col Thomas G. Guenther.

"National Strategy Implications of the Strategic Airlift Shortfall"—Lt Col Robert A. Larsen.

"An Evaluation of the Effects of Design Decisions on Weapon System Performance"—Col Steven T. Powers.

Air Command and Staff College

"Economic Viability of Militarizing Space"—Majors John K. Buffin and Gregory L. Gilles.

"Determining Manpower Workload Trends Using a Geometric Moving Average"—Major Bartholomew Como.

"Quality Circles Program Management"—Major Frederick L. Crawford II.

"Advocating Communications Systems of the Future—Whose Job?"—Major Henry J. Daries.

"Aircraft Maintenance Specialty Classification: Aircraft Specialists versus System Specialists"—Major John N. Edenfield, Jr.

"Warranted Hand Tools/Evaluation of Productivity Improvements"—Major James H. Fell.

"The Logistics of Winning Wars"—Majors Thomas P. Foss, Thomas D. Hatcher, James R. Lipsey, Ronald H. Owen, and James T. Reynolds.

"System Level Warranties/Incentives in Approach for Assuring Aircraft Readiness"—Major Kenneth M. Hentges.

"Proposed European Distribution System (EDS)—Is There a Better Approach?"—Major Richard G. Poff.

"Multiyear Contract Cancellation Ceiling—An Alternative to Full Funding"—Major Gary L. Poleskey.

"DoD Financial Management"—Majors George B. Smith and Michael F. Taylor.

"An Analysis of the AF Cost Analysis Program"—Major Donald A. Sutton.

"Project Warrior: On War"—Major Stuart J. Traster.

"Support of the Soviet Air Regiment"—Major James L. Waddell.

Loan copies are available through the Air University Library, Interlibrary Loan Service (AUL/LDEX), Maxwell AFB, Alabama 36112. Additional information on the ACSC studies can be obtained through ACSC/EDCC, Maxwell AFB, Alabama 36112 (AUTOVON 875-2483; Commercial 205-293-2483).

Recommended Reading for Professional Logisticians

Air Chief Marshall Sir David Lee, GBE, CB. *Flight from the Middle East*. London: Her Majesty's Stationery Office, 1980. (Available thru Pendragon, Inc. Old Mystic, Connecticut, 06372.)

Professor Donald W. Engels. *Alexander the Great and the Logistics of the Macedonian Army*. Berkeley: Univ. of Calif Press, (paper) 1981.

Lieutenant Colonel Harold W. Mack, USA Ret. *The Critical Error of WWII*. Washington: National Defense Univ. Press, 1981.

John M. Collins. *US-Soviet Military Balance*, (Concepts and Capabilities 1960-80). New York: McGraw-Hill Publications Co., 1980.

Colonel T.N. Dupuy, USA, ret. *The Evolution of Weapons and Warfare*. New York: Bobbs Merrill, 1981.

Economic Data Service, Aerospace Research Center. *Aerospace Facts and Figures, 1981/82*. Washington DC: Aviation Week (a division of McGraw-Hill Publications Co.) for Aerospace Industries Association of America, Inc., 1981.

The Impact of Rate Stabilization Upon the Air Force Depot Maintenance Industrial Fund (DMIF) Management System

First Lieutenant Kenneth S. Caldwell, USAF

Program Manager, Technical Data Systems

Air Force Logistics Command

AFALD, Wright-Patterson AFB, Ohio 45433

Abstract

This article reviews the DOD policy of rate stabilization within the Air Force Depot Maintenance Industrial Fund (DMIF) and presents several recommended changes which should help the industrial fund operate more efficiently. Also, top level managers in the industrial fund management structure were interviewed to obtain a comprehensive analysis of the impact of rate stabilization upon the DMIF.

Introduction

Amendment 10 U.S.C. 2208 of the National Security Act of 1947 authorized the Secretary of Defense to establish working capital funds to finance (1) inventories of needed supplies and (2) industrial- and commercial-type activities which provide common services within the departments and agencies of the Department of Defense (DOD). (2:10; 4:4) The Secretary of Defense later established the stock and industrial funds to help managers control their operations more efficiently.

In turn, the Air Force DMIF is a revolving fund that, within the limitations of a closed system, simulates commercial activity. In the artificial buyer-seller relationship established under this fund, the Directorate of Materiel Management is the buyer who purchases maintenance from the seller, the Directorate of Maintenance. Through several workload negotiations, Materiel Management agrees to buy projected amounts of maintenance at a stabilized price. This price can take two forms: an hourly rate which is used for all aircraft, missiles, and certain other specialized workload categories whose repair is labor-intensive or an end-item rate which is used for engines, exchangeables, and inertial guidance systems. Based upon these negotiations, Materiel Management then requests funds through the budgeting process. (3:1-2-1)

Overall, the objectives of the industrial fund as stated in Department of Defense Directive (DODD) 7410.4 are fivefold: (1) to provide a more effective means of cost control; (2) to recognize contractual relationships so management will have adequate incentive for efficiency and economy; (3) to provide managers the financial authority and flexibility to effectively use manpower, materials, and resources; (4) to use the facilities more economically by cross-servicing among military departments; and (5) to support the performance budgeting concept by facilitating budgeting and reporting costs. (4:3)

The main conceptual problem with the industrial fund is that it does not simulate a competitive business environment. (1:20) In this environment, the buyer is free to find the most economical way to accomplish a task, which may involve competitive bidding. In the depot maintenance structure, however, the buyer must purchase maintenance from one of the five air logistics centers (ALCs). There is no competitive bidding among the five ALCs because each has its own unique maintenance responsibilities. (1:19) Because these centers are extremely mission-essential to the Air Force, it is vital the depots maintain the wartime surge capability.

The nature of the constraints (no competition, surge capability) imposed upon the industrial fund has already diluted the ability of the fund managers to control and accurately account for all the costs within the ALCs. Rate stabilization as a management tool was initiated in FY 1976 within the stock and industrial funds to help cope with the problem of double-digit inflation.

Rate stabilization focused on two major problems that the industrial fund encountered. First, increasing operating and maintenance costs had depleted budgets, which made it impossible to carry out planned activities, thus impairing military readiness. Second, using inflation factors had caused the fund managers to frequently up prices to keep their fund in a reasonable profit/loss situation (variance from the budgeted position). This made it very difficult for the customers to budget operation and maintenance (O&M) effectively because they could not plan future fund charges. When prices increased, the ALCs accomplished less maintenance for the industrial fund customers (the operational commands proxied by Air Force Logistics Command (AFLC), the National Guard, etc.) and often developed idle capacity which led to inefficient use of manpower and materials, resulting in layoffs.

Policy and Rate Preparation

In FY 1976, DODD 7410.4 initiated a revised program of rate stabilization, which was established: (1) to stabilize rates within the stock and industrial funds at realistic rates; (2) to assure that adequate cash existed within the revolving funds; (3) to minimize the effects of inflation in setting rates for budgeting purposes; and (4) to resolve financial and managerial problems between the funds and the customer's appropriation activity. (2:18)

Under the 1976 change, hourly rates for aircraft, missiles, and other major end items, as well as unit sales prices for engines, are established at the ALC level approximately 17 months prior to the fiscal period they will be used. These ALC determined prices are then forwarded to HQ AFLC for review and approval and, approximately 14 months prior to the work period, these ALC/HQ AFLC approved rates are forwarded to HQ USAF for transmittal to OSD and OMB for their review. The final rates are determined as a result of the program budget decision (PBD) cycle and are established 9 to 10 months before the fiscal period in which the work is to be performed. It is possible that these final rates established during the PBD cycle may still be in use up to 26 months (number 14, Figure 1) after they were finally stabilized (number 8, Figure 1).

These predetermined prices established at the ALC level may or may not reflect actual costs within the depots at the time of execution. Factors such as high inflation, direct costs for materials and labor, productivity improvements, and PBD cycle decisions may cause the final price to differ substantially from the stabilized price. If there is a profit or loss in the depot maintenance industrial fund, due to these fluctuations, then the variance from the budgeted position (profit/loss) is returned in the next year's rates.

A report submitted to the House Committee on Appropriations by the Surveys and Investigations (S&I) staff

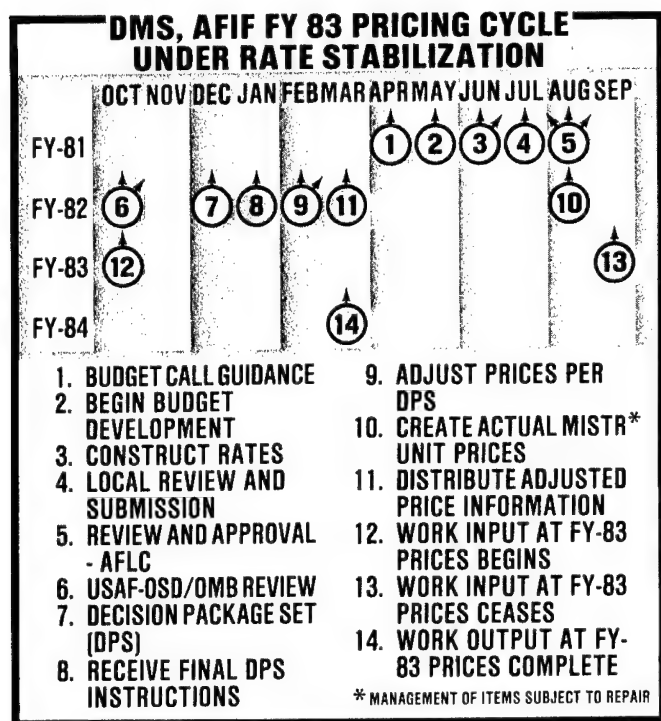


Figure 1.

found that the establishment of rates 18 months in advance obscured the true cost figures and also did not relate to the actual cost for the work to be performed. (2:73)

Rate changes however are permitted only on an exception basis and require OSD approval. Furthermore, such changes may only occur when the customer directs a change in work scope which results in a variance from the budgeted position (profit/loss) of \$500,000 on engines and \$50,000 on exchangeable end items such as avionics and landing gear. (3:6-3)

The S&I staff report also discussed three additional problem areas in which the implementation of the rate stabilization policy impaired the effective management of the industrial fund. The staff's first concern was the system peculiarities and inflexibilities of rate stabilization—it took management control away from the ALC fund managers and put it at a higher level. That higher level (OSD) then dictated inflation factors, activity level recoupment of losses, price changes, and price freezes for long periods of time. The staff then concluded that rate stabilization violated the basic principles of good industrial fund operations.

The rate stabilization system as operated is completely inflexible. Rates are not just set for the year, they are locked in concrete; thus creating an atmosphere which inhibits managerial initiative of flexibility. (2:74)

Secondly, rate stabilization weakened incentives for good managers.

The fact that an installation manager's success is no longer measured by his operating results is a radical departure from accepted commercial management practice and certainly affects his outlook. Now it is more a question of 'has he operated per estimates?' even though he is aware of weaknesses in the estimates from the beginning and may have requested their adjustment. Even if he makes a profit, he may be directed to raise his prices next year to 'recoup' losses of other installations in the same field of activity. Also, if he attains a good cash position, he may be directed to transfer some portion thereof to help 'bail out' a poorly managed fund. (2:74)

Because the industrial fund operates on a profit/loss basis with an objective to break even, there is no meaningful measure of efficiency. This is particularly true when costs are related to inflation, work volume, wage rates, etc., while profit is influenced by costs and how well prices are set in a noncompetitive environment. (1:44)

Finally, the staff concluded that rate stabilization completely shifted the risk from the customer to the industrial fund. It locked in the price, but not the variable customer workload.

[For] price/rate stabilization to be fully effective, [it] requires a degree of accuracy in estimating workload and prices that may or may not be possible in an operation as large, diversified, and complex as DOD's Industrial Fund Activity. (2:75)

Statement of the Problem

The policies established to implement the objectives of rate stabilization have created problems which significantly impair the ability of the fund managers to control costs. First, by stabilizing prices so far in advance, these managers have a very difficult time measuring cost against price as a benchmark for performance measurement. Second, several of these policies have taken financial authority and flexibility away from the fund managers.

Because of the disparity then between rate stabilization and the industrial fund objectives, three specific problems in managerial control have resulted. First, actual costs have exceeded estimates. This has happened because inflation factors (official estimates from OMB) for labor and materials, which are applied to current costs to establish the next period's prices, have historically been too low. The use of the 18-month predetermined price lead time based on OMB inflation guidelines has caused several price discrepancies. The resulting price variance due to the underestimation of inflation because of the sudden rise in metals cost of direct materials must then be absorbed by the industrial fund.

Second, some real costs have ultimately been lower than the estimates because of significant productivity improvements taking place during the 18-month interval before the estimated prices take effect. Although a conservative forecast of productivity improvements is allowed in predicting prices, unforeseen changes may lower the unit cost of an item to allow more maintenance than what was planned and budgeted for. If this happens, we can then assume there must be a backlog of work available at the ALCs and, second, there must be more maintenance needed than was budgeted for. Even if these conditions were met, OSD has generally disapproved requests to lower the stabilized unit price. OSD contends that the industrial fund can absorb profits or losses in the current year and dissipate them in future years. This approach, when viewed on this macro level, may at first appear logical, but is actually causing management and productivity deficiencies within individual ALCs.

A current OSD policy which helps to produce this impact is in the area of expendability, recoverability, repairability code (ERRC) claims. ERRC changes are now specifically excluded from price change criteria. When, for example, an engine goes through the repair cycle, it has many expense items (throwaway) that may or may not need to be replaced. When replaced, the item is drawn out of the stock fund inventory and the industrial fund is charged. As technology advances, an engineer may find a repair process for that item which would

make it more economical to repair than replace. If an item is repaired 95% of the time and replaced 5% of the time, its ERRC changes from being an expense item to an investment item. When replaced, the item cost is drawn out of the investment money, but is no longer charged to the industrial fund. Since the item is now an "investment" item, it is paid for through central procurement (CP) money. If this type of ERRC change occurs within the engine repair cycle, or a similarly expensive operation, and if thousands of these engines/items need to be repaired, then the industrial fund has to absorb the potentially large dollar amounts of profits.

Third, ALCs currently do not know the "should cost" of any repair item, which is the cost needed to repair an item based on standards, such as labor and materials. Rates stabilized 18 months in advance at the ALC tend to hide organizational problems. The technology to determine what something should really cost is currently available in the form of computer software, but Air Force ALCs do not yet possess the capability. The only cost that the ALCs can determine is actual cost, which includes the actual dollar amount of labor, materials, and overhead that went into the repair of an item. Currently, the ALCs can only compare that actual cost with the sales price. Since the sales price was established up to 18 months prior to the fiscal year, it is subject to 18-month guesswork. Between the time the price is set and the period the work is to be performed, many variables can change the actual cost needed to repair an item or render a service. For example, a change in work scope or mix by a customer can lead to actual cost differentials, which is extremely hard to quantify. A computer error or an OSD pricing policy change can also impact cost. If the actual cost is greater than the sales price, the organization should be able to determine why there is a difference in cost and, if it is correctable, fix it. Since the should cost is not known, however, managerial or operational inefficiencies may go undetected.

The problems above are significant to management for their financial impact alone, but are more important in terms of their impact on the mission readiness of the Air Force. If an ALC could lower its price for any reason on an item (while in an overall profit position), and thus enable more maintenance to be accomplished than budgeted for, the price change request should be approved by the OSD. Not only would this lowered price give the customers more readiness than anticipated but would also use up any idle capacity that might develop within the ALCs due to unforeseen productivity improvements.

A good example of a change which created both ALC idle capacity and an opportunity for users to receive more maintenance than scheduled occurred in 1979. The FY 1979 sales price for the F-100 engine core was projected to be \$43,483, which included \$7,537 to perform repairs on the high pressure turbine (HPT). In FY 1978, AFLC/LOP decided to manage the HPT as a separate module, effective 1 January 1979. This change in work scope meant that the San Antonio ALC, where F-100 engines were being repaired, lowered its core price to \$36,046. HQ AFLC requested a price change from OSD under the guidelines established, but it was disapproved. Although the work was done by the same people, the repair of the HPT was in effect paid for twice by the same F-100 budget, first through the engine package and second as a separate module. The core production schedule change resulted in an industrial fund profit in excess of \$1 million in FY 1979. Had the HPT not been paid for twice, more F-100 maintenance could have been accomplished at a time when F-100 engine problems were receiving high-level attention.

Conclusions

During my research, I interviewed 26 top level managers in the industrial fund management structure to obtain a comprehensive analysis of the impact of rate stabilization upon the DMIF. Questions and conclusions were as follows:

Do the goals of rate stabilization conflict with those of the industrial fund?

The goals of rate stabilization and the industrial fund *do indeed conflict* in some instances, resulting in a decrease in the ALC fund manager's control. Stabilizing the rates and not being able to change them has left contrasting price and cost as virtually a meaningless performance indicator. Since the ALCs have no concrete benchmark to measure costs against, the first goal of the industrial fund (to provide a more effective means of cost control) is violated.

The industrial fund was established as a business-type enterprise with a buyer-seller relationship. However, there has been doubt whether a buyer-seller adversarial relationship was ever created since both Maintenance and Materiel Management belonged to the same unit. Nevertheless, it was the job of Maintenance to set realistic prices and to break even by controlling costs. It was also the job of the buyer to monitor Maintenance and make sure the ALCs held costs down as close as possible to the original price. By implementing rate stabilization and by effectively allowing no price changes, any buyer-seller adversarial relationship which might have existed has been destroyed. This also inhibits the fund manager's ability to control costs; therefore, the first objective of the industrial fund can no longer be accomplished.

Several rate stabilization policies, such as dissipation of profit at the command level and infrequent price changes, have also taken some management control away from the fund managers. These policies violate the third goal of the industrial fund—to provide managers the financial authority and flexibility to efficiently use manpower, materials, and resources. The OSD policy of dissipation of profit at the HQ AFLC level has taken financial authority from ALC managers. The ALCs are now dependent on the ability of the other ALCs to control cost, rather than just worrying about their own.

Do the goal disparities cause cost and price discrepancies which inhibit both the AF's mission readiness and the ability of the maintenance manager to meet his goals?

If a backlog of maintenance exists and if prices were lowered in the year of workload execution, there would be two benefits which would enhance the mission readiness. First, appropriated funds which were committed to the preparation of a specific group of items could be freed, thus enabling more items to be repaired than originally anticipated. If the program receiving the price cut needed no more items repaired, then the freed appropriated funds could be rerouted to an organization in need of additional funds. By allowing either method, the mission readiness would be increased by an allowed reduction in the stabilized price. Second, today's dollar will buy more maintenance this year than it will in two years. When a price change is located, the earliest it can be incorporated into the system is "budget lead time away," which is normally two years down the road. Considering the time value of money, it would be more prudent to lower prices as soon as possible, thus enabling the additional money to be used today rather than the proposed saving be tied up in the budgeting process for two years.

Recommendations

The following rate stabilization policy changes are recommended to improve the ability of the fund managers to control costs:

(1) OSD SHOULD GRANT ALC MANAGEMENT THE FLEXIBILITY TO LOWER PRICES. All the Directors of Maintenance when interviewed said they would accept a rate stabilization policy that would *only* lower the price. They realize that an increase in price would decrease mission readiness and would also possibly create idle capacity within the ALCs, but they also understand that by decreasing their prices, when possible, the mission readiness could be enhanced if a backlog of maintenance existed and the ALCs had the capacity to perform the work.

(2) OSD SHOULD ALLOW DISSIPATION OF THE BUDGET VARIANCE TO BE DECIDED AT THE HQ AFLC LEVEL. Each ALC would like to stand on its own and should. The dissipation of the variance from the budgeted position should be left for HQ AFLC to decide, not OSD. If one of the ALCs is managed poorly, then the profit or loss created should be returned or charged to that ALC's customers, not equally spread to all the customers of all the ALCs. Why should a B-52 program manager have his price lowered because last year an F-100 engine manager was overcharged? That money should be returned to the F-100 program, not dispersed throughout the command.

(3) REALISTIC PERFORMANCE MEASUREMENT INDICATORS NEED TO BE ESTABLISHED WITHIN THE ALCs. There are certain basic principles of management which an organization must adhere to in order to operate successfully and efficiently. One is to establish a process where management sets realistic cost objectives and is held to them. Under rate stabilization, the ALCs no longer have price as a realistic cost objective because price and cost are no longer related during the work period. Therefore, the ALCs are missing an element essential to the control process, meaningful performance measurement. The ALCs need to establish a "should cost" accounting system so they can gauge their cost to some useful measurement criteria.

(4) THE PERCEPTION OF PROFIT AND LOSS NEEDS TO BE EXPLAINED AND UNDERSTOOD AT THE ALC, HQ AFLC, AND OSD LEVELS. OSD insists profit and loss are meaningless while ALCs insist that is what they are being judged on. The ALCs do not look for price changes, rather they look for ways to explain their profits and losses. It is recommended that the term "profit and loss" be renamed "variance from the budgeted position" and that top level ALC, HQ AFLC, and OSD managers determine just what they want this "variance" to represent in the industrial fund. Since the inception of rate stabilization, the break-even goal of the industrial fund is no longer a meaningful measure of performance.

(5) OSD SHOULD ALLOW THE ALCs TO APPLY BETTER INFLATION GUIDANCE FOR MORE REALISTIC PRICE ESTIMATES. Jet engine material components do not inflate at the same rate as sophisticated electronic components. Fund managers should be able to use inflation rates more closely associated with economic indicators. Next period's projected prices should be based upon economic guidance by categories which would more accurately estimate the inflation of individual components.

(6) OSD SHOULD ALLOW ERRC CHANGES TO BE CONSIDERED AS A VALID CRITERION FOR PRICE CHANGES. It is recommended that OSD include ERRC changes in its price change criteria. It is not good fiscal management (and is a waste of appropriated money) when an expense item becomes an investment item and the customer pays for it twice.

(7) OSD SHOULD ALLOW ERRORS IN PRICE AS VALID CRITERIA FOR APPROVAL OF PRICE CHANGES. Many customers of the industrial fund feel that the price should reflect real cost. Any cost errors should be corrected and the price adjusted accordingly. This policy, if enacted, could raise the price, thus requiring the customer to seek additional appropriations; but a realistic price would enhance performance measurement.

A Final Word

The ALCs need assistance in developing an accounting system for determining should cost within the resource control centers (RCCs). Presently, the RCCs are held accountable for overhead costs which are allocated to them, over which they have no control. An accounting system needs to be developed which would compare the actual cost to repair an item versus the cost it *should* take to repair that item (such as separating direct and overhead costs). Such a project would be useful in helping the ALCs further control their costs and measure their performance.

Also study needs to be given to a comparison between rate stabilization in the industrial fund and rate stabilization in the stock fund. The stock fund prices, unlike the industrial fund, are stabilized just prior to the fiscal year, enabling current cost estimates and more accurate pricing. The industrial fund, however, establishes many of its rates and prices up to 18 months in advance at the ALC level, but many of its prices are based on prices from the stock fund. Why should the stock fund be able to change its prices after the industrial fund has incorporated them into their budget? The OSD policy between the stock and industrial fund appears to be inconsistent. A detailed study contrasting the management approaches between the stock and industrial fund would be beneficial in helping determine which management technique is more effective.

This article has recommended seven OSD policy changes. Although the author considers these policy changes essential for the efficient operation of the fund, he also recognizes that these policy changes will create some initial instabilities in the system. However, the time has come to consider a change.

References

1. Buckingham, Charles. "The Buckingham Report, An Assessment of the Depot Maintenance Management System." Unpublished research report, unnumbered. The Air Force Logistics Command, Headquarters, Wright-Patterson AFB OH, undated.
2. Surveys and Investigations Staff of the United States House of Representatives. *A Report to the Committee on Appropriations, U.S. House of Representatives, on Price/Rate Stabilization Practices in the Working Capital Funds*, Department of Defense. Washington: Government Printing Office, April 1978.
3. U.S. Department of the Air Force. *Depot Maintenance Industrial Fund Procedures for the D/M and D/MM*. AFLCM 66-9. Washington: Government Printing Office, 1978.
4. U.S. Department of Defense. *Regulations Governing Industrial Fund Operations*. DOD Directive 7410.4. Washington: Government Printing Office, 25 September 1972.



Fashions in Warfare: Implications for the Tactical Aircraft

Dr. Leonard G. Gaston
Operations Research Analyst
Aeronautical Systems Division
Wright-Patterson AFB, Ohio 45433

Introduction

In an analysis prepared for a collection of predictive essays published in 1968, D. G. Brennan points out that fashions are powerful determinants of the shape of warfare and weapons development and that such fashions are usually based on "much less-than-detailed analysis of all alternatives."¹

Fashion had a part in the preeminence given to the horse and mounted knight in medieval European warfare. While the cost of mount and armor restricted the dominant role in warfare to the upper classes that could afford this expensive equipment, tradition and papal rulings often reduced the extent to which the participants injured one another and limited how often fighting was permitted. As long as combatants on both sides of any conflict obeyed this prevailing fashion, the system was relatively stable and there was strong resistance to change. It required an intrusive force from outside the system to produce such a change, and it took three successive massacres by the English longbow (at Crecy, Poitiers, and Agincourt) to emphasize the point to the remaining French nobility.

In his substantial text on technological forecasting, Joe Martino points out that, in more recent times, the impact of prevailing fashion has been strong. An idea or invention that promises to strengthen existing traditions or institutions will likely be welcomed, but one that appears to undermine tradition, or to alter a "society" (service or institution) from its own ideal image, will be resisted. He also describes two interesting cases involving the U.S. Navy:

(1) Scrapping the pioneer steam vessel, the *Wampanoag*, apparently occurred because, in the opinion of a review board, stoking furnaces, tending boilers, and operating steam machinery "... were incompatible with the type of shipboard life practiced in the days of sail."

(2) Disapproving a proposal to develop a battleship with a single-caliber main battery (a form which the battleship eventually did take) occurred when:

Alfred Thayer Mahan, one of the foremost naval strategists of all time, opposed this development. He did so on the grounds that ships so equipped would fight only at long range. Since before the time of Nelson, the proper course of action for a naval vessel was to close with the enemy and fight practically at arm's length. Mahan felt that the existence of long-range weapons would create what he referred to as an "indisposition to close," and that, as a result, the Navy would lose something which had been an important tradition.²

The power of prevailing fashion is still operative today and our conventional concepts for tactical aircraft may be based on a traditional, human-centered, and obsolete idea concerning the attributes that a single fighting entity should possess.

Characteristics of the Ideal Warrior

If we could travel back in time, to some period when battles were fought solely hand-to-hand, and ask a military leader about his best warriors, the answer would probably be: "The ideal warrior must have courage and a quick mind to calculate where to strike and how to avoid his opponents' attacks. He also must have sharp vision to view the enemy and the agility to avoid blows. And, most importantly, he must possess the endurance and physical strength to carry heavy weapons into battle and wield them with force."

It would be difficult to argue with this description of the ideal warrior for hand-to-hand combat, in either ancient or modern times. For, after all, a human being must be an indivisible entity if he is to function at all. But one could argue that this concept of the indivisible fighting entity spills over into our conceptualization of tactical aeronautical systems and prevents us from taking full advantage of technology.

If these attributes make an ideal warrior and, if he were then mounted on horseback, the resulting mobility and range of action could create a formidable fighting machine. In fact, over the centuries, with or without protective armor and projectile weapons, the mounted warrior did in fact become the key to battlefield success. According to the military historians, Richard Preston and Sidney Wise, Phillip of Macedon drew from his land-holding aristocracy a cavalry force which, when combined with an improved Greek infantry phalanx at the battle of Chaeronea in 338 B.C., "supplied the margin of victory and made Phillip master of Greece."³

With the addition of a projectile weapon, the Eastern Romans, centuries later, created a near-master weapon in the Byzantine horse archer.⁴ Later, other innovators chose to equip this mobile warrior with heavy armor. The result, according to P. E. Cleater, was a highly effective weapon system: "From the time of Charlemagne onward the plains of Europe were dominated by armored cavalymen whose shock tactics no foot soldiers of the day could withstand."⁵ I. B. Holley pointed out that, by the end of the Napoleonic era, cavalry had four accepted functions: the charge, reconnaissance, screening, and strategic cavalry. The last was the equivalent of what was later to be called interdiction: penetrating into rear areas to destroy supply dumps, bridges, and communications.⁶ Horses became so essential that they were always included in any war planning. As late as World War I, both sides confidently expected to use cavalry units armed with lances on a large scale. At the start of that conflict, Germany had 10 divisions of horse cavalry and Austria-Hungary 11. On the allied side, France had 20 such divisions and Russia 40.⁷

However, as gunpowder weapons improved, the real importance of horse cavalry gradually declined. The end

loomed suddenly, though, when an American, Hiram S. Maxim, visited Paris in 1881. There, Maxim encountered another American who held strong views about the propensity of European nations going to war periodically with one another. He reportedly told Maxim: "If you wish to make a pile of money, invent something that will enable these Europeans to cut each other's throats with greater facility."⁸ Only two years later, Maxim secured a patent for a belt fed repeating gun whose breech was operated to eject and reload by gas pressure from the preceding round. This weapon greatly improved upon Dr. Gatling's famous invention of 1864. Its rates of fire were so high that its barrel had to be cooled by water. Mechanical refinements followed one after another until by World War I "... the machine gun quickly showed itself to be the most effective death dealing instrument yet devised by man."⁹ In that war, when the Western front had stagnated, the combination of barbed wire and the machine gun led to stalemate and wholesale loss of life. As a result, according to Holley, British cavalry divisions on the Western front "... ate tons of costly fodder waiting for a day which never came when they hoped to exploit a breakthrough."¹⁰ The day of the horse-mounted warrior was over. A new form of mobility would be found to replace the horse. In fact, technology in the twentieth century was to provide a dramatic extension of that concept.

Tactical Aircraft

In the early 1940s, J. C. F. Fuller, a mobility expert and retired general, noted that the effectiveness of any weapon depends on five weapon characteristics: range of action, striking power, accuracy of aim, volume of fire, and portability. He observed further that range of action was dominant. The weapon of superior reach or range should be central to tactics. Writing prior to the first use of atomic weapons, Fuller described the "air-carried bomb" as the dominant weapon of the time. Its partially offsetting weaknesses (to which we today could add the aircraft's vulnerability to electronically guided surface-to-air weapons) were the low accuracy of aim of the aircraft and a low volume of fire due to the aircraft's need, once its bombs had been "fired," to return to its bases to reload. Prophetically, he says:

Could these limitations be surmounted, then the airplane would become what may be called "a master weapon" - that is, a weapon which monopolizes fighting power.¹¹

In the absence of defenses to fully exploit its relative softness and consequent vulnerability, the aircraft carrying nuclear bombs briefly did become that master weapon.

Furthermore, it is probably fair to say that the tactical aircraft of modern times has functioned as the equivalent of the dashing cavalryman of the nineteenth and earlier centuries, with gun and rocket replacing saber and lance. But just as barbed wire and the machine gun drove the horse from the battlefields of the world, the wizardries of computers and electronics applied to surface-to-air weapons may be driving the traditionally conceived tactical aircraft from the air.

If this is so, it should not be surprising. The march of technology through the ages has brought about first the ascendancy, then the decline, of one weapon after another. Fuller probably expressed it best:

Man is eternally inventive. No sooner does he bring a system of destruction to perfection than the constant technical factor - the urge to

eliminate the danger he has created - under the whip of disaster compels him to seek yet another.¹²

Before, during, and immediately after World War II, advances in aerodynamic and power plant design created a phenomenally capable new vehicle for the air cavalryman to ride. Electronic devices sharpened his vision and control over vehicle and weapons. But the same electronic advances that provided marginal improvements to the attack aircraft eventually brought forth gigantic strides in anti-air capability. The tactical aircraft began to face an increasingly lethal battlefield environment, with diminishing chances of survival.

That this is so is obvious. But what to do about it has not at all been obvious, because we still tend to think in terms of a concept that would have been familiar to the ancient military leader. The ideal warrior, or the fighting entity, must be all these things combined: clear-eyed, quick-witted, and strong-armed. We are comfortable with the ancient idea of mounting the warrior on a horse to add speed and range of action, or even in an airplane to create a still more capable fighting entity. But our concept of attributes the fighting entity must possess is still a prisoner of the past.

"War Birds"

The clearest look at some problems is by analogy, and this problem lends itself to that approach. Let us think of tactical aircraft as birds (sometimes indeed they have been referred to as "war birds") and ask ourselves what these birds should look like. On one hand they should probably be patterned after the swallow—a swift, elusive, sharp-eyed little bird which darts through the air, almost impossible to follow with the eye, and unerringly snatches its prey in midair. But the swallow could carry only the lightest of payloads. For load-carrying capability, it would be better if the tactical aircraft were more like a buzzard, a bit slow and ponderous perhaps, but able to carry a very satisfactory payload for some considerable distance. Such a design concept, of course, would be extremely vulnerable to hostile fire: a design optimized for cargo-hauling capability becomes, over the battlefield, something of a "sitting duck."

What has been the conventional solution? Compromise, of course. Aircraft designers have ingeniously used advances in aerodynamics, structures, and power plants to build better compromises. The result, in our era, has been something between a swallow and a buzzard, an intermediately sized and performing bird more like a hen, or perhaps a turkey. Beautiful aluminum sculptures though they may be, however impressively photographed on the ramp with their potential loads spread out before them, they are nevertheless compromises. Because they are bigger and less elusive than swallows, designers must load them up with armor, countermeasures, and stand-off missiles in attempts to decrease their vulnerability. And because they are smaller than buzzards, they must repeatedly endure hostile fire, visiting the target area again and again to discharge their hen-sized loads.

That this is so is because we have not yet fully realized the degree to which the electronic technology that once tipped the battlefield balance against the conventional attack aircraft can also have the reverse potential to overturn it the other way, in favor of the attack aircraft. We have failed to see that the wonders of electronics will permit the designer to put the sharp eye, keen mind, strong back, and strong arm of the ideal warrior model in different places, and yet make them function as one system.

To illustrate by using our bird analogy: First: although some targets may be difficult to locate under any circumstances, we can assume that normally the swallow could do a better job of darting in to locate targets than could a hen. Second: although complex and costly power plants and structures have increased the load-carrying power of compromise designs, the best compromise hen will still trail a well-engineered, optimized buzzard in range, load, and loiter. Third: for the final phase of weapon delivery, another variety of swallow-like bird (a stand-off missile, possibly rocket-powered) could more likely reach its target than our same compromise hen, which by now may be getting short of feathers.

Conclusion

It has been suggested by various writers that our numbering system may be human-centered; that is, built on a base of ten, because we humans have ten fingers and toes. There seems to be some logic in the idea. It is just as logical to suggest that our concept of war machines continues to be influenced by our human-centered concept of the ideal warrior—the idea that a fighting entity should, in one package, have all the attributes or capabilities already enumerated. But in the case of tactical air vehicles, there are sound reasons to take advantage of the fact that modern electronics and computing know-how can provide a functioning “nervous system” widely spread through space: that the eye, the brain, the strong back, and the strong arm of the warrior entity can be built as specialized, optimized machines, thus giving the parts, and the whole, much greater survivability and effectiveness.

Why not a tactical air attack system with these parts?

(1) Swift, darting swallows—either advanced “Aquila”-like pilotless vehicles*—or, if necessary, relatively small, agile, high performance platforms carrying human operators and supplemental sensors—to find targets and pinpoint them in a locational grid (and to return to designate them when extreme accuracy for moving targets is required).

(2) Optimized, load-carrying buzzards, operating away from the dense thicket of battlefield air defenses, to bring up the weapons—and to possibly carry a computing capability to maintain a locational reference grid.

(3) Swift, unmanned, rocket or jet-powered swallows, guided from carrier to target by electronic, single-track minds.

Are such systems really impractical? Or have we not built them because we have been prisoners of our human-centered, millennia-old perception that a single war-fighting entity must possess all the attributes of the ideal warrior, in one package?

*The Army's Aquila program, which equips a small (6 feet, 10 inches long), remotely piloted vehicle with a TV camera, microprocessor, target-tracker, and a laser ranger/designator, demonstrates the vast potential of unmanned scout vehicles.

Editor's Note: Although this article is not logistics “per se,” it deals with a condition of mind which may be affecting our approach to support and sustainability. We chose it for this issue to pique your interest and perhaps generate a response. One of our article referees was so inclined and his comments follow this manuscript.

The theme or message that, fashions and traditional thinking impair rational analysis of alternatives, reaches the conclusion that swift swallows have human operators (civilians from Wright-Patterson?) with sensors. This seems to me to be oxymoronic to the original theme. For example: Assuming that we are prepared to fight limited wars without going for the heartland, and discounting the (facts?) that the F-15 and F-16 were built for, air shows and

defense economy maintenance, manned tactical aircraft are in my opinion obsolete - right now.

Today's progress against tradition, and quite possibly within our technology, should seek to develop “throw away” electronically controlled, drone swallows with TV camera sensors, bouncing reconnaissance and control signals off satellites. “Pilots” would be safely seated and “fly” from space or in front of underground monitor screens. The advantages of getting the pilot out of the bird are:

(1) High speed, high “G,” less stress for pilots. (That flying a drone is less stressful is already documented.) More flexible and controllable than missiles.

(2) No armor, no escape systems, electronic; satellite bounce, no downed pilots to rescue, no POW's. Pilots still have something to talk about at the club. Still wear wings.

(3) Much less logistics required for hot areas. Buzzards with ordinance (but not logistic condors, which still would have aircrews who operate in areas with drone established air superiority) are replaced with missiles.

Serving a physiological function, the fashion of wearing clothes is well established in humans. Almost on the same order of tradition is the notion that aircrew members must be aboard tactical weapon systems. The author gets me excited all the way to swift darting swallows, and then analogously wallows in “futuristic thinking” that was probably inspired by a World War II movie i.e., darting swallows: P-47, P-51, Spitfire; more range, armor, swallows: P-38; light buzzards: A20-A, Mosquito (RAF); buzzards: B-25, B-26; eagles: B-17, B-24, B-29.

Colonel Richard B. Pilmer

Notes

¹Brennan, D. G. “Weaponry,” *Toward the Year 2018* (New York: Cowles Education Corporation, 1968), pp. 1-28.

²Martino, Joseph. *Technological Forecasting for Decision Making* (New York: American Elsevier Publishing Company), p. 82.

³Preston, Richard and Sidney Wise. *Men in Arms* (New York: Praeger Publishers, 1970), pp. 28-30.

⁴*Ibid.*, pp. 52-53.

⁵Cleator, P. E. *Weapons of War* (New York: Thomas P. Crowell Company, 1968), p. 95.

⁶Holley, I. B. “Horses, Airplanes, and Spacecraft: The Search for Doctrine.” A paper prepared for and presented at the USAFA Military Space Doctrine Symposium, 2 April 1981.

⁷Cleator, p. 174.

⁸*Ibid.*, p. 155.

⁹*Ibid.*, pp. 158-159.

¹⁰Holley.

¹¹Fuller, J. C. F. *Armament and History* (New York: Charles Scribner's Sons, 1945), p. 8.

¹²*Ibid.*, p. 126.

Logisticians Are Leaders, Too!

Dennis E. Campbell

Assistant Professor of Maintenance Management
School of Systems and Logistics
AFIT, Wright-Patterson AFB, Ohio 45433

Once, while I was being introduced to some fellow Army officers (tactical types), I was referred to as a “loggie.” Upon hearing the term, immediate bewilderment showed on their faces. Smiles and laughter soon appeared when my host explained that I, as a loggie, was to be found “in the rear with the gear.” I graciously attempted to explain that logisticians “developed, delivered, and maintained the means for the tactician to fight.” More laughter and disbelief followed.

Try as I did, I was unable to convince my new acquaintances of the importance of the logistician's role. Their views of military glory and achievement centered on such things as the dynamics of battle while waging war, fighter aircraft and artillery providing close-in support, bayonet charges, throwing one's self on grenades, etc. To them, acts of heroism typified leadership . . . and logisticians just did not qualify.

Logisticians dealt with requisitions and numbers, fixed broken things, handled dirty sheets and laundry, and were concerned with the "ash and trash details." "Logisticians do not take the initiative; they are not out front; they *manage* people, things, and systems; they do not lead," they said.

I have never forgotten the impressions made during that conversation, and I am grateful to have learned another lesson of the tactician's perception of the logistician. But, alas, since that occasion, those and similar perceptions have been echoed many times over. To the inexperienced tactician, logisticians are a necessary evil . . . sort of a second class citizen. But the experienced tactician—perhaps one who has survived because of a logistician—recognizes what I have loudly proclaimed, even before that conversation. And that revelation is something that all "loggies" should advertise to the world: Logisticians are leaders, too!

That is right! Logisticians *ARE* leaders! They lead by action, voice, and by deed—through service to their customer—whether the customer is a tactician or another logistician. And they do a *VERY GOOD* job of it, too!

Granted logisticians are not actually up front in the trenches. But they really are not supposed to be. Their battleground is somewhat different. The logistician has his own version of close-in support, bayonet charges, and smothering grenades. Places like ammo dumps, maintenance tents, ports and terminals, POL tank farms, convoys, and warehouses may not be very heroic sounding . . . but they are the logisticians' battlefield. Here is where the logistics leaders do all they can to win their battles and war and pass the advantage to the tactician.

Logistics leaders are a unique lot. They are team players, and they play on many teams—offense, defense, and speciality. They develop and provide new weapons for the tactician; they recover equipment and supplies; and they repair and return temporary equipment losses back to the tactician for reuse. They purge storage and pipeline areas to maximize the support effort at the lowest cost. It is easy for the logistical leader to develop and execute plans such as these. But the real mark of his leadership is seen in his follow-up and follow-through. He is dedicated at making the system work—the first time.

Logistics leaders are much more. They are among the first to break the molds of archaic thinking to become creative. Tasked to do more with less, they do so and, through better organization, streamline processes and systems, and develop "the logistics state-of-the-art." "Closed Loop," "Containerization," "Quick Reaction/Mobile Maintenance," "Inventory in Motion," "Throughput," and "Logistical Offensive" did not just happen. Logistical leaders took the initiative and hammered out each creative step in the process.

Logistics leaders instill cooperation and teamwork. They are adept at cutting through red tape and making things happen. They plan, execute, and replan with the goal of optimum efficiency and effectiveness—in both human and organizational dimensions. Staff and workers are coached to excellence; high-quality performance is caused by unit pride and accountability. They insist their people *think* on the job and accept nothing short of the very best performance. They keep their people informed, knowing that an informed worker meets and accomplishes tasks better. Skills, not rules, are emphasized. Controls are used to guide the organization, not to stifle it.

Tactics and battle strategies are studied to better serve the tactician and become a valued asset. The logistics leader

remains aware of the tactical situation and advises the tactician on logistical matters affecting the tactician. Logistics leaders recognize and proudly play their role of advising the tactician on when to fight *before* the fight begins.

They are dedicated to doing the job right—the first time. They forge the way by preventing and correcting problems *BEFORE* they become problems. The logistics leader competes for quality performance and sacrifices personal goals to better serve his customers and troops. Obstacles are challenges; problems become tasks. The logistics leader uses new and creative methods to sharpen the skills of his people and trains himself and his organization to provide quality service to the user. "Desert Strike," "Wintershield," "Team Spirit," "Reforger," and "LOGEX" are but a few humble examples.

Yes, logisticians are leaders, too! They are creative, innovative, competitive, and professional. They listen to their people *and* to their customers . . . blending their wants and desires with the mission . . . they develop confidence in their people and trust them to do their jobs. Teamwork and cooperation are important to the logistician. Plans and contingencies call out the best of the organization's capabilities. A logistician is quick to recognize and reward good performance, and watches with pride while his unit excels.

Thinking back upon the conversation and the perceptions about logisticians the tacticians revealed, I have asked myself, "Should logisticians be one of the glory boys?" No, logisticians are not into that, for that is not the mission of the loggie. Sure he is in the rear with the gear and not directly in the heat of the battle or in the trenches . . . but that is where he is supposed to be. However, in battle, his physical presence is felt—felt by those who use the beans, bullets, and beds . . . present in the sandbags, weapons, and ammunition. And the tactician knows it . . . some more vividly than others.

Yes, logisticians *are* leaders! They know what needs to be done, and they do it. They develop the strategies, and they carry them out. Can Do . . . Want To . . . *AND* Do!

Plan Ahead—Make Things Happen

Lieutenant Colonel Walter R. Montgomery, USAF
Chief, Infrastructure Planning Branch
Air Force Logistics Command
Wright-Patterson AFB, Ohio 45433

Everyone plans for future events: marriage, retirement, vacation, TDY, or a new baby. Webster defines a plan as an orderly arrangement of parts of an overall design or objective, or a goal. On the job, many of us are required to plan for things which may or will happen. As we anticipate those future events, we want to be in full control of the situation if possible. We do not want the events to control us, and we do not want costly surprises. By careful planning, we can often gain control and anticipate our reactions in advance.

Because planning involves many, if not all, organizations on the base, each function, activity, or unit needs to help decide how things will be done. Coordination of the plan with the tasked activities is one kind of effective planning participation. Also, it is often desirable to actually have the

tasked activity write a portion of the total plan and then coordinate it among all parties. The lifeblood of successful planning is active review, discussion, and agreement.

As commanders and their staffs plan for military force readiness, some useful tools will serve them well:

(1) Set some realistic, attainable goals and periodically monitor the progress in achieving these goals.

(2) Delegate authority and assign tasks to assure that personnel realize they are accountable for their stewardship.

(3) "Institutionalize" insights and experiences (audits, trip reports, histories, and after-action reports) into procedures, directives, and plans.

(4) Look beyond the current crisis, attempt to make your own answers where none exist, and then sell them to higher headquarters.

(5) Participate in exercises, conferences, and deployments, as a means to expand understanding, open dialogue, and solve problems jointly.

(6) Take care of your people (superiors, coworkers, and "customers") and much of the mission will take care of itself.

Basic to the readiness of our military forces and underlying all planning is the reality of the enemy threat. Commanders and staff managers must understand the enemy and its threat to our nation and allies. Next in importance, at base level, is the need for planning actions to involve, in the process, all tenant units along with any other base players. Further, commanders and managers must know their capabilities and should understand what can be done by working together. Also, attention is required to visualize the WHO, WHAT, WHEN, WHERE, WHY, and HOW MANY, while contrasting the NOW with the THEN. In doing these things, careful attention must be given to identify assumptions. What is being assumed? What is clearly stated? What is implied but not stated? The answers to these questions are crucial.

Other plans, already written, can be useful and often commanders and managers borrow concepts from these plans. Sometimes other plans set preconceived limits or restrict what can be creatively done. It is essential to have an understanding of all associated plans and their interrelationships so that what should be useful does not become a millstone.

Commanders and key staff people need to be knowledgeable of each plan and all their assigned tasks. Briefings, discussions, and exercises are all good ways to bring home the essentials of particular plans. Too often a commander does not have time to really study a set of plans. Thus, the staff must highlight the ideas, relationships, and problems with special emphasis upon any pitfalls in order to keep the commander and key staff informed. Success is only possible when difficulties

are addressed and completed staff work is directed at problem resolution. Creation of effective alternatives or "work-arounds" may also be needed.

Planning is a big job. It requires continual refinement, much imagination, and considerable energy. Planning is particularly necessary in peacetime, when plans are never fully exercised. By careful attention to military planning, we may perhaps save lives and other scarce resources which cannot be readily replaced.

Following are some of my perspectives about planning:

(1) There are knowns, known-unknowns, and unknown-unknowns. The more things we get into the first two categories, the fewer surprises we will have. Think things through carefully, and insist that others do the same. Know what the plan seeks to accomplish. Consider and address all reasonable possibilities, however remote, in terms of the established goal.

(2) Since everyone has to be somewhere, relax and enjoy doing the best possible job with what you have. Document lessons learned and continue to improve the operation. Refine gray areas of uncertainty.

(3) Absolutely nothing will go 100% perfectly. Plan if you can afford it for the worst case. This will give necessary flexibility for plan implementation and adjust to reality.

(4) When planning, remember that no one understands what you do; instead you must understand what everyone else does. Become conversant with all areas of the operation, at least so you know which are the important questions to ask.

(5) You know more about your base or operation than anyone at higher headquarters or joint component units. They need to know your informed perspectives, reasons, and insights. Keep open, effective communications alive.

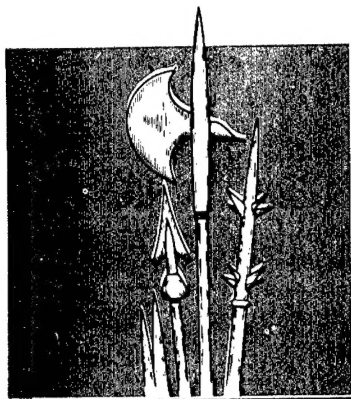
(6) Store any management reserves of time by carefully planning before the crisis. Time is a most precious resource—guard it jealously and use it wisely.

(7) Guidance rarely exists in sufficient detail to permit a rigorous, mental checklist toward a planning problem. However, intensive, sensitive questioning pays high dividends. Consider and address all conceivable possibilities. Some generalized checklists may be useful.

Whatever the planning tasks, it really pays to involve everyone who needs to know or to do something. Use their good ideas, experience, and talent. Whether planning a war or a picnic, the results will be better if everyone with responsibilities has an active part in the planning. By careful attention to the objective or goal, planning makes things happen.

Best Article Written by a Junior Officer

The Executive Board of the Society of Logistics Engineers (SOLE) Chapter, Montgomery, Alabama, has selected "DMES: A Micro Application With a Macro Payback" (Fall 1983 issue) by First Lieutenant Kirk A. Yost, USAF, as the best AFJL article written by a junior officer for FY 83.



Project Warrior

Project Warrior is a concept formulated to create an environment where our people can learn from the warfighting lessons of the past and use that knowledge to better prepare for the future.

Logistics Warrior

Logistics Warrior is the contribution of your journal to help create that environment. Your suggestions are solicited.



LOGISTICS WARRIORS: Plan Ahead

Despite all of today's verbiage and verbosity on preparing and planning for war, we still pay only lip service to the concepts. Would today's logistics system work in war? It would, I suggest, be foolhardy to answer that question in the affirmative. But that is what it is all about; that is why we are in this business.

Please allow a long-in-the-tooth logistician to reminisce for a few moments and draw on his World War II and pre-World War II experiences and memories in order to make some comparisons. Admittedly, these experiences were not with the United States (US) military; they were with the Royal Air Force (R.A.F.). However, Logistics Warrior appears to be seeking lessons learned from history, and it may not be inappropriate to take a look at how the R.A.F. met great logistics challenges almost 45 years ago.

As you may recall, the political climate in Great Britain in the thirties was not especially conducive nor encouraging for war planning. Prime Minister Chamberlain had returned from Munich, waving his ubiquitous umbrella and declaring that there would be "peace in our time." Fortunately, the top echelon of command in the R.A.F. did not accept this reading of the international situation, and every plan and every directive was directed to the possibility, indeed the expectancy, of war. I first put on the blue uniform at this time and from then until 3 September 1939, when war was declared on Germany, it was drilled into me, almost on a daily basis, that "a day of peace is a day of training for war," "a day of peace is a day of training for war."

I was constantly reminded that this was the only reason for the existence of the R.A.F., and the only reason that I was in it. Have we, perhaps, forgotten this premise today? Should we remind ourselves—on a daily basis, as I was jolted in the late thirties—why we are working for the Department of Defense? In the daily shuffling of papers should we not, perhaps, remind ourselves why the Department of Defense exists? It exists for one reason, and one reason only—to provide this country with a military force so strong that it will deter aggression, with a secondary objective (if the first fails), to fight a war and win. Are we achieving the prime objective? Could we achieve the secondary? If not, what can and must be done about it?

Those are, of course, rhetorical questions; but, nevertheless, questions that we should be asking ourselves. I suggest that we can look at history and get some guidance on what we should be doing.

Returning to my reminiscing of those prewar days of the late thirties, I recall that the impact of the "plan-for-war" philosophy was manifest in the direction that every staff officer received. Clear and precise directives were given that *no* procedure, *no* system, *no* regulation, *no* form would be designed or written that did not meet and completely satisfy the criterion "will it work in war?" This one simple criterion dictated every regulation, procedure, and instruction that was issued; it governed every form and every element of the logistics system. The proof of validity of this philosophy became evident in September 1939 when the transition of the R.A.F. from a peacetime Force to a war-ready Force went smoothly and orderly. Systems, procedures, and forms did not need to be changed. Longer hours, of course, had to be worked and activities had to be accelerated. "Routine" gave way to "Expedited," but still within

the priority system established in prewar conditions. This flexibility was built into the system. I am concerned, today, when I see personnel working long hours, trying to meet impractical deadlines, and generally slogging away on special projects.

I also witness many aspects of the logistics systems being subjected to constant expedited priorities. If we are required to work excessive hours today, and if everything is priority in peacetime, where is the flexibility we will need when an emergency hits? I suspect there will not be much working room.

These questions are posed so that all who are responsible for the logistics support of military forces will ponder their responses and examine critically what needs to be done to reach the objective. The logistics system of today must meet the 1939 criterion—"will it work in war?"

By: B. Joseph May, Professor, SOSL, AFIT.

LOGISTICS WARRIORS: "Collins on Planning"

"Defense planning, a dynamic process, takes place in a matrix, much of which is non-military. Comprehensive and foreign policy planning, which are complementary, proceed simultaneously through five stages in constant flux.

Step 1, which specifies purpose, takes precedence. Step 2 appraises opposition. Step 3 formulates strategy to satisfy objectives in the face of all obstacles. Step 4 allocates resources to cover requirements without intolerable risk. Step 5 reviews alternatives, if available assets are insufficient to support preferred concepts."

"Defense planners seek to protect and promote assorted interests that form the foundation for national security."

"The nature, imminence, and intensity of apparent perils determine what (if anything) should and could be done in what order of priority to safeguard U.S. interests from all foes, both foreign and domestic."

"Experienced defense specialists recognize that the best intelligence estimates are often fallible, and try to fashion strategies that will work if prognostications prove wrong."

"Conceptual planning ascertains what should be done to satisfy critical security interests. Resource allocators compare resultant requirements with present and projected capabilities, in terms of forces and funds, to confirm or deny feasibility."

"Reconciliation is essential when unacceptable risks occupy the breach between ends and means. At least six choices, singly or in combination, are available:

- Reduce waste
- Compress or discard objectives
- Reshape strategic concepts
- Revise force requirements
- Increase resources
- Bluff"

"The five planning steps summarized above rarely occur in Utopian sequence. Except in times of dire emergency, U.S. leaders tend to downgrade national defense, glossing over or assuming away many potential threats. They try to walk a tightrope between excessive defense expenditures that emasculate political, economic, social, scientific, and ecological programs on one hand, and deficient defense expenditures that endanger national security on the other. Experience shows, however that success is spotty whenever planners skip steps or overstress one at the expense of others."

From: *U.S. Defense Planning: A Critique* by John M. Collins.

LOGISTICS WARRIORS: Lessons Learned from World War I

"Exactly what are the lessons to be derived from the experience of the United States with the air weapon during World War I? These lessons are much the same as those which might have been derived equally well from the Civil War or, for that matter, from any other war. As was true of former conflicts, World War I emphasized the necessity for a conscious recognition of the need for both superior weapons and doctrines to ensure maximum exploitation of their full potential. As a corollary to these two requirements, the war pointed up the need for administrative agencies to ensure their fulfillment once they have been recognized as requirements. The experience of the war showed clearly that wherever military authorities failed to emphasize the need for better weapons rather than more weapons they suffered serious disadvantage. Aerial warfare along the front proved

that an enemy with fewer but superior weapons was fully capable of containing an opposing force with an impressive numerical predominance. Quality paid better dividends than quantity.

The experience of the war also demonstrated that where military authorities failed to formulate a doctrine to exploit each innovation in weapons to the utmost they suffered further disadvantage. The example of bombing aircraft presented an outstanding instance of this neglect. Not only did the military authorities fail to get bombers into production for immediate use during the war, but as a result of their neglect of doctrine, the air arm acquired no body of experience from which to derive an acceptable concept of aerial warfare. Lacking such a concept or doctrine, the air arm had little to give authoritative direction to development of aircraft for the future.

Finally, the experience of the war showed that the failure to emphasize better weapons rather than more weapons and the failure to attach sufficient importance to the formulation of doctrine issued directly from inadequate organization. The war revealed that adequate organization fell into two general categories. The first of these involved organizations for information, that is, agencies for objective, systematic compilation (at all levels of operations) of facts, and of facts, indeed, about aerial warfare and doctrines of air power both foreign and domestic, facts regarding tactical developments to serve as a basis for countermeasures, facts about technical developments, about the result of proof tests, and about scientific findings for possible application to weapons. The second of the two categories of organization involved means for making decisions. The war showed the necessity of organizations at all echelons for making authoritative decisions based upon information systematically, objectively, and continuously accumulated by responsible and effective organizations especially created to gather data. At the same time, the events of the war showed that decisions based upon opinion, memory, a limited range of personal experience, or emotional bias led only to failure. These were the lessons of World War I, but did the air arm learn them?"

From: *Ideas and Weapons* by I.B. Holley, Jr.

Item of Interest

Automated Flying and Maintenance Scheduling (AFAMS) Program

Maintenance Plans and Scheduling (P&S) has one of the most demanding base-level missions in the Air Force. Their plans for flying and maintaining the aircraft fleet must blend the efforts of the flight line, inspection docks, specialist shops, support equipment shops, and operations to meet the unit's flying goals.

Inputs come from everywhere (shop chiefs, maintenance staffers, aircraft depots, major commands, and operations planners), and then all want their inputs to be reflected in the schedule. In addition, the scheduler must consider hundreds of inspections, time change items, time compliance technical orders, and delayed discrepancies, and ensure that they also are shown in the schedule. And, finally, when P&S picks aircraft to fly the missions, they must make sure each one has the right systems working and the right mission equipment installed.

How can we give schedulers the time they need to schedule effectively? The Air Force Logistics Management Center (AFLMC), in close association with the Air Force Data Systems Design Center (AFDSDC) and base-level schedulers from all over, is working on the answer. Over the past couple of years, AFLMC has been in the process of developing a computer model called the Automated Flying and Maintenance Scheduling (AFAMS) program which will give schedulers a computer assistant that thinks like a scheduler. AFAMS actually makes routine scheduling decisions based on rules which can be set or changed by the individual scheduler. The program comes complete with an override feature that gives the scheduler the final word on every action.

Preliminary field trials of AFAMS have shown that the program can handle a large share of the routine event scheduling workload. Experienced schedulers can build schedules in only a fraction of the time used in typical manual processes. More importantly, the program never forgets to schedule an event no matter how many times or how radically the schedule is changed. The goal of AFAMS is to handle the small jobs and give the scheduler time to effectively handle the big ones.

The Data Systems Design Center is currently considering the model as a candidate for implementation in the Core Automated Maintenance Systems (CAMS) in mid-1986.

Captain John M. Turner
Air Force Logistics Management Center

"No one had ever heard of a quartermaster in history."
(Greene on being promoted Quartermaster General by Washington.)

Air Force Journal of Logistics
Air Force Logistics Management Center
Gunter AFS, Alabama 36114